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DE LA PEÑA (F.). **La campaña contra la langosta en 1939–1940.**—*Publ. Serv. Lucha contra la Langosta* no. 8, 31 pp., 6 pls., 2 maps. Madrid, 1941.

As a result of the lack of locust control during the civil war in Spain, an extensive outbreak of *Dociostaurus maroccanus*, Thnb., developed in 1939 in the Provinces of Badajoz, Caceres, Ciudad Real, Toledo and Madrid, and, on a smaller scale, in some others. In the autumn of 1939, over 300,000 acres were found infested with locust eggs, but the surveys were incomplete and hatchings in the spring of 1940 extended over more than 395,000 acres. The density of infestation varied from about 84 to 1,600 egg-pods per square yard. The organisation of the campaign was centralised under a delegate of the Ministry of Agriculture, while a resident agricultural expert, with a staff of foremen, supervised the work carried out by landowners in each province and district. About 84 per cent. of the infested areas were ploughed, but by the end of December the work was completed in only 30 per cent. of the area, and the general results were such that a spring campaign against hoppers had to be conducted over most of the treated areas, as well as in those in which egg-deposits had not been discovered. For the spring campaign, 115 supply centres were established, so that no infested area was more than 48 hours distant from one. Several control methods were employed, but the best results were obtained with poisoned baits, for which sodium arsenite was the poison chiefly used. Over 222,000 acres were thus treated; the rates of application varied according to the density of infestation, but averaged the equivalent of 27 lb. bran per acre. Spraying with sodium arsenate was carried out over some 37,000 acres. Sheet iron barriers, of which over 8¼ million feet were in use, proved very helpful in cases of heavy concentrations of hoppers. Gasoline, mixed with gas-oil, was used for spraying and burning hoppers over more than 34,500 acres, but the method proved expensive and inefficient. About 5,900 tons of young hoppers were caught with nets, but this method was also ineffective and extremely expensive. Detailed costs of the campaign are given by provinces, the total expenditure being over 2,800,000 pesetas, apart from the expenditure by municipalities and private landowners, which is assumed to be about as much again. During the campaign, entomologists conducted various investigations [*cf. R.A.E.*, A **29** 459–461], the results of which will be used in future campaigns. Apart from *Dociostaurus maroccanus*, *Calliptamus italicus*, L., is of importance in some areas in the Province of Albacete, while the Tettigoniids, *Decticus albifrons*, F., *Platystolus surcularius*, Bol., and *P. martinezi*, Bol., are minor pests in the Province of Madrid.

HUBER (L. L.) & STRINGFIELD (G. H.). **Strain Susceptibility to the European Corn-borer and the Corn-leaf Aphid in Maize.**—*Science* **92** no. 2382 p. 172. New York, N.Y., 1940.

This is an account of an investigation in Ohio on strain susceptibility in maize to the corn-borer, *Pyrausta nubilalis*, Hb., and *Aphis maidis*, Fitch. Among maize hybrids grown in north-western Ohio significant correlation coefficients of 0·570 and 0·844 were found in different seasons between expected Aphid infestation based on Aphid susceptibility ratings of the parent inbred lines and estimates of actual corn-borer infestations. Estimates of Aphid abundance were based on

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actual counts of infested plants, those of corn-borer abundance both on counts of infested plants and on stalk breakage. The practical application of the correlation between corn-borer and Aphid infestations in the same plots lies in the fact that the degree of Aphid infestation may be used as an index to the degree of strain susceptibility to the corn borer, at least for preliminary classifications of maize-breeding material. Counts of Aphid colonies can be made rapidly and easily, as compared with the difficulty in estimating the abundance of corn-borer infestation.

McGregor (E. A.). **A new Spinning Mite attacking Strawberry on the Mid-Atlantic Coast.**—*Proc. ent. Soc. Wash.* **43** no. 2 pp. 26–28, 6 figs. Washington, D.C., 1941.

Descriptions are given of adults of both sexes of *Tetranychus atlanticus*, sp. n., from strawberry in Virginia, Maryland, and North Carolina, and red clover in Idaho. It is understood that on several occasions strawberry plants have been shipped into Idaho from Maryland, which may account for the presence of the mite there. It was first collected in Maryland in May 1939.

Buchanan (L. L.). **A new Species of *Smicronyx* from Saskatchewan, and synonymical Notes (Coleoptera : Curculionidae).**—*Proc. ent. Soc. Wash.* **43** no. 2 pp. 29–32, 12 figs. Washington, D.C., 1941.

This paper includes descriptions of adults of both sexes of *Smicronyx utilis*, sp. n., which was collected in June 1939 at Regina, Saskatchewan, where it is stated to attack the noxious poverty weed, *Iva axillaris*.

Brown (A. W. A.). **Foliage Insects of Spruce in Canada.**—*Publ. Canada Dep. Agric.* no. 712 (*Tech. Bull.* 31), 29 pp., 2 pls., refs. Ottawa, 1941.

It is stated in this paper, which is based largely on the results of the Canadian Forest Insect Survey [*cf. R.A.E.*, A **28** 514, etc.], that approximately 37 per cent. of the total timber resources of Canada is composed of five species of spruce, with their intermediate forms. Since softwoods are easily killed by defoliating insects, a list is given of the 101 species, arranged under families, that have been taken feeding on the foliage of spruce, together with notes on the numbers of samples and individuals received, food-plants, frequency, distribution in Canada, bionomics and, in some cases, parasites. Although about 70 of the species are Lepidoptera, sawflies, of which only six species have been recognised, are in many respects the most important group. The only two leaf-eating species of outstanding importance in Canada at present are the Tortricid, *Harmologa* (*Cacoecia*) *fumiferana*, Clem., which is a native insect, and the European spruce sawfly, *Gilpinia polytoma*, Htg. Probably eight other species are more or less harmful, the commonest of these being the sawflies, *Pikonema alaskensis*, Rohw., and *Neodiprion abietis*, Harr.

Lists are also given of nearly 90 insect predators taken on spruce and of 20 additional species, of which nine are Elaterids, commonly found on spruce foliage, showing their distribution in Canada and the numbers of samples received, together with keys to the more important species mentioned in the paper.

BALCH (R. E.). **The Spruce Sawfly Outbreak in 1930.**—*Pulp Pap. Mag. Canada* February 1941 repr. 4 pp., 1 map, 2 refs. Montreal, 1941.

The outbreak of *Gilpinia polytoma*, Htg., on spruce in eastern Canada was reduced in 1940 by weather conditions, disease and parasites.

In New Brunswick, a rather dry May and cold, wet June resulted in delayed and rather low emergence, only some 55 per cent. of the overwintering cocoons producing adults. In the Gaspé Peninsula, with its later season, there was an unusually high emergence, approaching 70 per cent. These conditions tended to increase the population of young larvae in the Gaspé, and to reduce it in more southerly two-generation areas.

The disease that killed large numbers of the feeding larvae in 1939 [*R.A.E.*, A **29** 38] became more widespread and caused greater mortality in 1940. It was first observed in central New Brunswick about mid-July, when the earliest larvae began to spin cocoons. In many places a large proportion of those that were not mature at the end of July were killed, and, as the season progressed, they became infected in the earlier instars, so that few reached maturity at the end of the season. In northern New Brunswick and the lower altitude of the Gaspé Peninsula, the disease appeared later, and was generally less severe. In the interior of the Peninsula, where it had not previously been observed, mortality became severe only after most of the larvae had spun cocoons in September. It also appears to be present over a wide area north of the St. Lawrence, though it has not yet caused high mortality. There were a number of areas in which it was not very effective and the sawfly increased considerably, but these were the exception rather than the rule. It is probable that the disease will continue to be a valuable control factor, especially as it causes considerable mortality in lightly infested stands and is not dependent on crowded populations of larvae. In August 1940, it was more apparent than it had been in 1939 near trees that had been sprayed in that year with an extract of diseased larvae [*loc. cit.*], but it subsequently appeared over most of the surrounding district, and evidently did not need artificial introduction. Reference is made to its occurrence in New Hampshire and Vermont [*cf.* **29** 422, 423] ; it is also widely distributed in Maine, but is rather less important there than in New Brunswick.

Parasitism of *G. polytoma* by native insects did not increase, but introduced parasites were of some importance. The rapid increase of *Microplectron fuscipenne*, Zett., and *Exenterus* spp. in 1939 [**29** 38, 39] reduced adult emergence in the spring of 1940. In areas where the disease was prevalent it not only reduced the number of hosts available, but also caused the death of parasites, particularly *Exenterus* spp., that attacked diseased larvae and could not complete development. Weather conditions were also less favourable to the parasites than in 1939. Investigations by W. A. Reeks in the one-generation area and studies in the two-generation area indicated that ground temperatures greatly influence the activity and reproduction of *M. fuscipenne*. The accessibility of the coccoons to attack depends more on the temperature of the forest floor where they are spun than on the mechanical obstruction conferred by depth and composition of the floor covering. The ground temperature also determines the number of generations. *M. fuscipenne* is therefore likely to remain more effective in the

two-generation region than in the northerly one-generation areas. The percentage parasitism was generally lower than in 1939 and did not usually exceed 10, though some collections showed up to 56 in two-generation areas.

Four species of *Exenterus* have become established against the sawfly in Canada [*cf.* **29** 294] and are capable of parasitising many of the feeding larvae in both one- and two-generation areas. In the heart of the Gaspé Peninsula, *E. claripennis*, Thoms., has increased steadily, and in 1940 it destroyed the larvae in 15 per cent. of the sound cocoons at the place at which it was liberated in 1933. In a district in Quebec and one in New Brunswick, in both of which the disease was prevalent, the total population of *Exenterus* was reduced, but the percentage parasitism of sixth-instar larvae was reported to be 39 and 33, respectively.

Though the disease checked the parasites and tended partly to replace them, they continued to destroy many of the remaining sawflies and were able to maintain themselves even with a low host population, so that both *Microplectron* and *Exenterus* spp. will remain permanent potential factors of control. As these parasites attack other species of sawflies, and *M. fuscipenne* has already been recovered from the larch sawfly [*Pristophora erichsoni*, Htg.], they possess possibilities of more general value.

The distribution and degree of infestation by *Gilpinia* in Canada and the United States are shown on a map ; there was little difference in distribution, but areas of heavy infestation were considerably reduced. The population was larger in the central Gaspé, but was reduced in much of the coastal region and New Brunswick. On one plot near Fredericton, the number of sound cocoons per sq. ft. averaged 6·7 in October 1939, but only 0·25 in October 1940. There was little increase in defoliation and mortality of spruce in 1940 outside the Gaspé area, and in it the total mortality by volume of white spruce [*Picea glauca*] (74·3 per cent.) and black spruce [*P. mariana*] (43·5 per cent.) represented only a slight increase over that in 1939 [**29** 37].

Attack by *Dendroctonus piceaperda*, Hopk., was virtually absent, but secondary bark-beetles, chiefly species of *Dryocoetes*, *Ips* and *Polygraphus*, were present in nearly all the dying trees.

BRIERLEY (P.) & SMITH (F. F.). **Mosaic and Streak Diseases of Rose.**—*J. agric. Res.* **61** no. 9 pp. 625–660, 10 figs., 29 refs. Washington, D.C., 1940.

An account is given of the symptoms of rose mosaic or infectious chlorosis and rose streak, the distribution of the former in the United States and Canada and of the latter in the United States, and the relative susceptibility to them of various varieties of rose. The means of spread of the two viruses are discussed. In experiments, both were transmitted by tissue union only. In 1932–35, the ability of 30 Jassids, four Aphids, eight other Homoptera, and a thrips to transmit one or both of the diseases was tested in Virginia with negative results. These insects comprised all the potential vectors commonly found on roses and some from neighbouring vegetation. Attempts to transmit certain other recognised viruses from other plants to rose by means of their known insect vectors were also unsuccessful.

FULTON (R. A.) & ROMNEY (V. E.). **The Chloroform-soluble Components of Beet Leafhoppers as an Indication of the Distance they move in the Spring.**—*J. agric. Res.* **61** no. 10 pp. 737–743, 3 maps, 6 refs. Washington, D.C., 1940.

The amount of reserve energy in females of *Eutettix tenellus*, Baker, as measured by their chloroform-soluble components was studied by a method developed by the senior author, with a view to its use as an indication of the distance that leafhoppers found in cultivated areas have travelled from their breeding grounds. Collections of leafhoppers were made in 1932 along the suspected dispersal route from the Colorado River drainage north-eastwards into western Utah, in 1933 along the route from southern Arizona to Grand Valley, Colorado, and in 1932, 1933 and 1934 along a shorter route in southern Idaho, and the females were analysed for chloroform-extractive content. The percentages of extractives showed a more consistent decrease as distance from the breeding ground increased than did sweep-net counts [*cf. R.A.E.*, A **26** 283], although the data corroborated each other. Along the first route, the percentages decreased from 38·4 in females taken 110 miles from a point within the breeding area to 8·9 in those taken 315 miles from it. Along the second, they decreased from 39·5–46·3 at points within the breeding area to 6·6 at a distance of nearly 400 miles from it. In southern Idaho, the average percentages for leafhoppers collected in breeding areas were 38·5, 35·1 and 25·7 in the three years, respectively, and the corresponding percentages for those in beet fields were 38·0, 33·9 and 18·4. The closeness of the figures for the two areas confirms the belief that the beet fields of this district are infested from adjacent breeding grounds [**20** 608]. The reason for the low percentages in 1934 is not known.

GARMAN (P.) & TOWNSEND (J. F.). **Control of the Pear Psylla in Connecticut.**—*Circ. Conn. agric. Exp. Sta.* no. 143, 12 pp., 9 figs. New Haven, Conn., 1941.

Psylla pyricola, Först., is probably the most important insect pest of pear in Connecticut, where it has three generations a year. It overwinters in the adult stage under rough bark or other places in or near the orchard. During spring and summer, eggs are deposited in small twigs and bud scars or in crevices when the temperature reaches or exceeds 50°F.; oviposition has been observed as early as 2nd April and continues for about a month. The nymphs hatch after about 30 days in spring and 11 in midsummer and reach maturity about 30 days later. Females of the first two generations oviposit a few days after emergence, but those of the third do not oviposit until spring. Both nymphs and adults suck the sap from the leaves. By 1st June, the leaves may be discoloured as a result of nymphal feeding and the appearance of a sooty fungus that is associated with it. Later in the season, the leaves drop and the vitality of the tree is decreased. The Psyllid appears to be most abundant in wet seasons. Natural enemies are probably of importance in control, since there is a considerable seasonal fluctuation in numbers, but the only parasite known to occur in Connecticut is *Psylledontus insidiosus*, Crwf., which attacks the nymphs.

Control of the Psyllid is briefly discussed. The recommended measures comprise delayed dormant sprays against the overwintered

adults or summer sprays ; the latter are most effective when applied after rain, which dissolves the protective viscous fluid secreted by the nymphs. Delayed dormant sprays containing 3 per cent. lubricating oil, the specifications for which are given, should be applied when the buds are beginning to open (generally during the first two weeks in April in Connecticut) and when the temperature is fairly low (40–50°F.) so that the adults do not fly readily. There is some residual effect, probably due to the ingestion by the Psyllids of sap containing toxic substances absorbed by the tree. Where infestation is heavy, supplementary sprays in July may be neccessary. Dormant sprays should not be applied to weak trees and should be omitted every third year in old orchards. An alternative schedule comprises two applications in May, or one in May and one in early June, of a spray containing 1·5 gals. white summer oil (viscosity 60–80 seconds and unsulphonatable residue 90-100 per cent.) and 1 pint nicotine sulphate in 100 gals. spray. In some seasons, a further application in July or even as late as 15th August may be necessary, and for these, and when sulphur is being used, soap or some other suitable spreader should be substituted for oil to avoid injury to the trees. Three spray schedules for the control of *Psylla pyricola* and other pests of pear on weak and vigorous trees of varieties that are susceptible to scab and on varieties that are not susceptible to it are given in a table. Preventive measures comprise the selection of sites on high or sloping land for new plantations, and planting and pruning the trees to avoid dense growth, which favours the Psyllid.

MARCOVITCH (S.) & STANLEY (W. W.). **The Tomato Fruit Worm in Tennessee.**—*Bull. Tenn. agric. Exp. Sta.* no. 174, 18 pp., 9 figs., 17 refs. Knoxville, Tenn., 1941.

MARCOVITCH (S.) & STANLEY (W. W.). **Control of Tomato Fruit Worm and Corn Ear Worm.**—*Circ. Tenn. agric. Exp. Sta.* no. 72, 4 pp., 4 figs. Knoxville, Tenn., 1940.

An account is given in the first of these papers of observations on the bionomics and control of *Heliothis armigera*, Hb., chiefly on tomatos and also on lima beans in Tennessee. The following is based on the authors' summary. *H. armigera* is the most important pest of tomato in Tennessee. The larvae bore into the fruit and sometimes destroy 25 per cent. of the crop. Oviposition begins as soon as the young fruits begin to set (about mid-May in early seasons), and young larvae and injured tomatoes usually occur in late May or early June. Natural enemies include the egg-parasite, *Trichogramma minutum* Riley, and the predators, *Orius* (*Triphleps*) *insidiosus*, Say, *Hippodamia convergens*, Guér., and *Ceratomegilla* (*Megilla*) *maculata*, DeG. In 1931–33, large-scale liberations of *T. minutum* were made in tomato fields, but the results were disappointing. When strips of maize were planted among tomatos, the infestation was increased [*cf. R.A.E.* A **14** 274]. Light-traps of the electrocutor type gave negative results. A synthetic cryolite (Alorco), lead arsenate and calcium arsenate were tested in baits and sprays, and the best results were given by a bait of 10 per cent. cryolite in maize meal or cottonseed meal. Three applications were made, at the rate of 40–60 lb. each per acre, the bait being applied by hand to the fruit clusters. Sprays of cryolite at the rate of 3 lb. to 50 U.S. gals. water gave good control. Cryolite can safely be used on tomatos as it offers no residue problems.

Good control of *H. armigera* on lima beans [*cf.* **26** 509] was obtained by a spray of 8 lb. cryolite in 150 U.S. gals. water. Magnesium arsenate (5 lb. in 100 U.S. gals.) was of no value, and laboratory tests showed that it possessed practically no toxicity against *H. armigera*

In the second paper, the work on the control of *H. armigera* on tomato is summarised, and reference is made to the mineral-oil treatment developed by G. W. Barber for its control in the ears of sweet maize [*cf.* **26** 745]. This method gave good control in Tennessee.

CHARLES (V. K.). **A Fungous Disease of Codling Moth Larvae.**—*Mycologia* **33** no. 4 pp. 344–349, 1 fig., 9 refs. Lancaster, Pa., 1941.

A disease due to *Hirsutella subulata* was observed in larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., in Virginia in 1940, where in one orchard possibly as many as 40 per cent. of the larvae were killed by it. The fungus was also observed by the author on collections of larvae of *C. pomonella* from Indiana in 1927 and from Delaware in 1930. In the latter case, the fungus was reported to be effectively reducing their numbers.

HARDMAN (N. F.) & CRAIG (R.). **A physiological Basis for the differential Resistance of the two Races of Red Scale to HCN.**—*Science* **94** no. 2434 p. 187, 2 refs. New York, N.Y., 1941.

An account is given of observations on the reactions to hydrocyanic acid gas of the two physiological races of *Aonidiella aurantii*, Mask., the one resistant and the other non-resistant to it [*cf. R.A.E.*, A **22** 99; **29** 399], using examples of two pure strains obtained from California. Females in the last instar, 46 of the resistant and 17 of the non-resistant race, were removed from their food-plants (squash or grapefruit) prior to fertilisation and placed in a closed chamber under the microscope, and their spiracles were carefully observed while several dilutions of HCN were admitted to the chamber. There is no observable difference between the two races in the structure of the spiracles, the opening and closing of which are concurrent with a pulsation of the tracheal trunk. In the normal insect this pulsates from the open to a partly closed position about 60 times a minute. When either race was exposed to HCN, the spiracles closed within 3–5 minutes after the fumigant reached them. In the resistant race they remained closed for at least 30 minutes, provided that HCN was present, and the scales survived a lethal concentration for at least this period. In the non-resistant race, however, they opened after about a minute and death followed in a short time if the concentration of HCN was lethal. There seems no doubt that the relative ability of the two races to maintain closure of the spiracles is sufficient to explain the difference in resistance to the gas.

ARK (P. A.) & TOMPKINS (C. M.). **Control of Red Spider** (*Tetranychus telarius*) **by Phthalic Glyceryl Alkyd Resin.**—*Science* **94** no. 2435 pp. 212–213. New York, N.Y., 1941.

It was observed in the course of experimental work in California that when a 2 per cent. phthalic glyceryl alkyd resin in water was applied to plants seriously infested with *Tetranychus telarius*, L., the

mites quickly disappeared. Microscopic examination of infested leaves showed large numbers of dead mites in all stages of development and masses of eggs that had turned yellow and shrivelled after five days. No injury was observed on plants tested experimentally under greenhouse and field conditions. Concentrations lower than 2 but not lower than 1 per cent. were effective against the adults but not against the eggs, while concentrations higher than 2 per cent. scorched the edges of the leaves. A list is given of the plants sprayed without injury to the leaves; they included lucerne, almond, apple, apricot, grape-vine, plum, strawberry, tomato and many flowering garden plants. An unidentified mite occurring on ivy and China asters (*Callistephus chinensis*) and a begonia mite, probably the Oribatid, *Avrosia translucens*, Nietn., were also successfully controlled by a single application of a 2 per cent. solution of the resin. This spray leaves no residue on the plants, possesses a high spreading capacity and has no disagreeable odour.

Back (E. A.). **Bookworms.**—*Smithson. Rep. 1939* (Publ. 3572) pp. 365–374, 18 pls. Washington, D.C., 1940.

This general account of insects that injure books, chiefly in the United States, includes information on their habits, and it stresses the importance of the damage that can be caused by them and the ease with which they can be distributed in untreated books [*cf. R.A.E.*, A **28** 354]. In connection with control and preventive measures, an account by A. E. Kimberley is quoted of a method employed for fumigating unopened packages of newly acquired material with a mixture of ethylene oxide and carbon dioxide in a vacuum fumigation vault. The vault containing the packages is evacuated until a vacuum of approximately 29·9 ins. of mercury is obtained, and the mixture of ethylene oxide and carbon dioxide is introduced until the vacuum falls to 21 ins. The gas is agitated by pumping it out at the top and in at the sides of the chamber, and after exposure for three hours the chamber is re-evacuated to 29·8 ins. of mercury, the vacuum broken with air and the containers removed.

Mills (H. B.). **Montana Insect Pests 1939 and 1940. Twenty-eighth Report of the State Entomologist.**—*Bull. Mont. agric. Exp. Sta.* no. 384, 28 pp., 8 figs., 3 refs. Bozeman, Mont., 1941.

In 1939 and 1940, grasshoppers were again the major pests of crops in Montana but were represented almost entirely by *Melanoplus mexicanus*, Sauss. The large swarms of this species that invaded Montana in the second half of 1938 [*R.A.E.*, A **28** 369] oviposited in the east-central area, laying large numbers of eggs in idle and reverted lands and in depleted range that was being invaded by weeds. Though poison bait was distributed, the area was so large that great numbers of grasshoppers reached maturity in the autumn of 1939; they migrated, again primarily in a north-westerly direction, but laid almost all their eggs in crop or idle land, so that the range did not present so serious a problem in 1940 as it did in 1939. In 1940, there were no migrations commensurate with those of 1938 and 1939. *Aulocara elliotti*, Thos., was second only to *M. mexicanus* in the State in 1937, but in 1938 its numbers and those of associated range species were negligible. *M. bivittatus*, Say, appeared locally in irrigated

valleys. The total crop losses attributable to grasshoppers and the value of crops saved by control measures were estimated at nearly 3 and 7 million dollars in 1939, and about 2 and 7 million dollars in 1940. The annual survey of grasshopper eggs has proved most valuable, and the accuracy of prediction of control requirements has increased year by year.

Following the peak in 1937–38, infestation by the Mormon cricket [*Anabrus simplex*, Hald.] has decreased greatly, the area infested in 1940 being only 19 per cent. of what it had been in 1938. Control work was responsible for much of the reduction. Apart from the mortality due to dusts, baits and barriers, it appeared that when the adults are disturbed a large proportion of the eggs they lay will not hatch. Natural enemies of importance included the Scelionid egg-parasite, *Sparasion pilosum*, Ashm., the predacious Sphegid, *Palmodes laeviventris*, Cress., which was very abundant in certain areas in 1940, and various birds.

Serious injury was caused by pests of clover in the Flathead district, the important species being *Dasyneura leguminicola*, Lint., which greatly reduced the yield of seed, the root-borer, *Hylastes* (*Hylastinus*) *obscurus*, Marsh., and the Aphid, *Anuraphis bakeri*, Cowen. Brief notes are given on the bionomics of the Cecidomyiid, which had been recorded in Montana only once previously. The Pentatomid, *Chlorochroa sayi*, Stål, has attacked grain crops in Montana every year since 1932 and has sometimes been very destructive locally. The adults overwinter beneath mats of weeds, straw, etc., and there is a spring generation primarily on weeds. The overwintering populations can be reduced by destroying the winter quarters, and reverted fields bearing annual weeds should be returned to grass. A list is given of insects recorded from stored grain, with brief notes on their appearance and habits; fumigation with carbon bisulphide is recommended against them. Damage to potato by *Paratrioza cockerelli*, Šulc, was far less serious than in 1938 [**28** 370]. Part of a large planting of head lettuce was practically a complete loss following heavy infestation of the roots by *Pemphigus bursarius*, L. After the discovery of this Aphid, the rest of the field was well irrigated, and the damage to the plants was slight. *Chermes* (*Adelges*) *cooleyi*, Gill., was abundant on spruce, but some trees in stands of *Picea engelmanni* were heavily infested, while others close by were almost free. *P. albertiana* and *P. abies* (*excelsa*) were more heavily infested than native spruces. *Chermes* (*Pineus*) *pinifoliae*, Fitch, attacked *P. engelmanni* in one locality at an altitude of about 9,000 ft.

Larvae of the Eumolpid, *Paria canella*, F., which had not previously been recorded from Montana, killed several hundred strawberry plants in one locality by feeding on the roots. Infestation of sugar-beet by *Loxostege sticticalis*, L., was light in both years, and though the adults were abundant in 1939, few eggs were laid. Injury to apples by *Cydia* (*Carpocapsa*) *pomonella*, L., increased markedly in 1940 in western Montana, and losses were fairly high in spite of good spraying programmes.

Two termites have been found in Montana, *Zootermopsis nevadensis*, Hagen (damp wood termite) and *Reticulitermes tibialis*, Banks; the latter is widespread and occasionally damages timber in buildings. The only earwigs that occur in the State, both of which are imported species, are *Labia minor*, L., which is of little importance, and *Forficula auricularia*, L., which was first recorded there in 1939, but had probably

been introduced several years previously. It can be controlled by a poison bait containing 12 lb. bran, 1 lb. sodium fluosilicate and 1 U.S. quart fish oil, which should be scattered in places where the earwigs may hide and has given good results in Oregon.

LIZER Y TRELLES (C. A.). **La lucha moderna contra la langosta en el país.** [Modern Methods of Locust Control in Argentina.]—31 pp., 2 pls., 4 figs., refs. Buenos Aires, Acad. nac. Agron. Vet., 1940.

A summary is given of recent work against locusts in Argentina, most of which has already been noticed [*cf. R.A.E.*, A **26** 689; **28** 60, 215, etc.]. The periodicity of invasions of *Schistocerca paranensis*, Burm., is discussed in relation to sun-spots, and it is concluded that maximum locust activity is in inverse relation to the number of sun-spots [*cf.* **24** 810; **27** 485].

The usual control measures are described, including brief notes on the good results obtained in laboratory and field trials with dusts containing dinitro-o-cresol. In 1939, experiments were carried out on dusting stationary and flying swarms with dinitro-o-cresol from an aeroplane, and their complete success led the author to suggest that locust control in Argentina should be directed mainly against adult swarms hibernating in dense aggregations in the northern parts of the country, which would be particularly susceptible to aeroplane dusting. Aircraft for this purpose should be under the direct control of the Ministry of Agriculture, and a project for an aeronautical section of the Ministry is under discussion.

[CLEARE (L. D.).] **Entomology.**—*Adm. Rep. Dir. Agric. Brit. Guiana 1939* p. 10. Georgetown, 1941.

In 1939, the Amazon fly [*Metagonistylum minense*, Tns.] maintained its control of *Diatraea saccharalis*, F., on sugar-cane in British Guiana until the long drought began. On one estate, three fields examined in January showed an average percentage parasitism of *D. saccharalis* by this Tachinid of 40, with a minimum of 6·6 and a maximum of 66·6 [*cf. R.A.E.*, A **28** 547]. No example of *D. canella*, Hmps., was parasitised in these fields [*cf.* **27** 505]. The proposed introduction of the Tachinid into Malaya [*cf.* **28** 322] was temporarily abandoned since, owing to delays due to war conditions, all the examples shipped died in transit to England. Outbreaks of the coconut caterpillar [*Brassolis sophorae*, L.] occurred in various districts.

OSORIO (J. M.). **Un nuevo hospedero en Cuba de *Euplectrus platyhypenae* (Chalcidae-Elachertidae).** [A new Host of *E. platyhypenae* in Cuba.]—*Rev. Med. trop. Parasit.* **7** no. 1–2 pp. 15–16, 3 figs. Havana, 1941.

The Eulophid, *Euplectrus platyhypenae*, How., was bred from single larvae of *Laphygma* (*Prodenia*) *eridania*, Cram., in a vegetable plot in Cuba in 1938 and 1941.

WILLE (J. E.). **Tres informes de observaciones entomologicas en la costa en 1940.** [Three Reports on entomological Observations in 1940 in the coastal Region of Peru.]—*Inf. Estac. exp. agric. Minist. Fom.* no. 53, 26 pp., 7 pls. Lima, 1941.

The author carried out surveys in various coastal valleys in northern and southern Peru in 1940 and in these reports gives brief notes on the status of the principal pests of crops observed in them and methods that are or should be adopted for their control, and makes recommendations for an extension of the work of local government entomologists. Most of the pests mentioned have been noticed from annual reports [*cf. R.A.E.*, A **29** 509, etc.]. In the northern valleys, the most important are those that attack cotton. *Platyedra* (*Pectinophora*) *gossypiella*, Saund., does not occur in Peru, and a study was made of methods of preventing its introduction from Ecuador. *Dysdercus ruficollis*, L., causes severe injury to cotton in the Santa and Nepeña Valleys, where it breeds throughout the year on *Sida paniculata*, but is absent from other valleys. Further north, in the Departments of Piura and Tumbes, it is the most important pest of cotton and is accompanied in some localities by *D. minimus*, Say. *D. ruficollis* was thought to pass the hot dry season on wild Malvaceae in the mountains, but in December these were very lightly infested and did not afford sufficient protection from the sun. Observations showed that it leaves these food-plants in October or November and migrates chiefly to a wild species of *Solanum* that grows abundantly at altitudes of 6,500–10,000 ft. It returns to wild Malvaceae when the rains begin in January and migrates from them to cotton in late May or early June, remaining on it until August.

Of the pests of fruit trees in these Departments, the most important was *Anastrepha chiclayae*, Greene, which infested fruits of mango and cherimoya (*Annona cherimolia*).

The pests in the southern valleys that are dealt with in most detail are those that attack fruit trees. The most harmful in the Tacna Valley is *Anastrepha fraterculus*, Wied., which was observed attacking guava and *Annona cherimolia*. For control of this Trypetid, it is recommended that its winter host-fruits should be eliminated; this would involve the destruction of about 1,175 trees, chiefly guava and *A. cherimolia*. In addition, apples, mangos and several other fruits should be collected and destroyed in June–September. *Scolytus rugulosus*, Ratz., caused serious injury to the trunks and branches of plum, apple, peach, almond and cherry. Infested trees should be severely pruned and the prunings destroyed, and the trunks of all susceptible trees should receive a lime wash twice a year. Injury to apple by *Cydia* (*Carpocapsa*) *pomonella*, L., was slight during the survey. Other pests mentioned include *Eriosoma* (*Schizoneura*) *lanigerum*, Hsm., on apple, some varieties of which showed resistance to infestation, *Diaphania nitidalis*, Stoll, on cucurbits, *Lineodes integra*, Zell., the larvae of which infested the leaves of chillies [*Capsicum*], and *Schistocerca paranensis*, Burm., which caused serious injury to cotton and maize in the oasis of La Yarada. Poison baits were ineffective against this locust, but good results were given by dusting and spraying cotton with calcium arsenate. *Saissetia oleae*, Bern., infested olive in several valleys, but has been satisfactorily controlled by introduced parasites in Yauca and Ilo [*cf.* **28** 514].

ANDREWARTHA (H. G.). **Some Laboratory Tests with Oil Emulsions against Wheat Weevil,** *Calandra oryzae.—J. Dep. Agric. S. Aust.* **44** no. 6 pp. 307–308. Adelaide, 1941.

An attempt was made in South Australia to discover a liquid insecticide suitable for destroying weevils on old stacking sites prior to storing new season's wheat, since doubt existed regarding the effectiveness of sheep dips and other insecticides in present use. In preliminary tests, sodium arsenite, sodium fluoride, copper sulphate, lime-sulphur, derris, white and red oils, a tar-oil emulsion used on fruit trees, and arsenical and tar-oil sheep dips were either ineffective or too costly. The results of preliminary tests with three emulsions of a fuel oil, each of the miscible oil type and used against weevils in dilutions ranging from 1 in 5 to 1 in 160, indicated the possible importance of the nature and quantity of the emulsifier in determining the degree of mortality obtained, since one emulsion was far more effective than the others and most effective at the higher dilutions. This was confirmed in further experiments with emulsions (mayonnaise type) of fuel oil, red and white spraying oils and deodorised kerosene, each containing 70 per cent. by volume of oil and used at dilutions of 1 part in 10, 40 or 80 parts water against cultures of weevils comprising 95 per cent. *Calandra oryzae,* L., and 5 per cent. *C. granaria,* L., by a dipping technique that is described. A proprietary emulsifier (Agral 3) was employed, at concentrations of 10, 5 and 3 per cent. by volume in the stock emulsion. Dilutions of 1 in 80 appeared to be slightly less effective than the others, but the difference was significant only in the case of kerosene ; a dilution of 1 in 40 would probably be most suitable for field trials. There was no significant difference in effectiveness between the four oils, of which fuel oil is the cheapest, but there was a marked difference in favour of the emulsions prepared with the smallest quantity of emulsifier. The author suggests that the emulsions containing a high proportion of emulsifier were less effective because they were more stable, and that the relative stability of many proprietary emulsions recommended for use on fruit trees may explain their unsatisfactory results against wheat weevils.

JENKINS (C. F. H.). **Notes on Control of Weevils in Wheat.**—*J. Dep. Agric. W. Aust.* (2) **17** no. 4 pp. 411–417. Perth, W.A., 1940.

An account is given of recent investigations in Western Australia on the control of *Calandra oryzae,* L., in wheat sacking by means of dips and in stored wheat by means of inert dusts. In the first series, batches of 30–50 weevils were confined in pieces of wheat sack and submerged in the liquids to be tested, after which the bundles were allowed to drain for 24 hours, the weevils removed to a tube, and the mortality noted. Immersion in cold water was employed as a control, and the percentage mortalities given by immersion for 10 minutes and 7, 12 and 16 days were 2, 10, 34 and 100, respectively. Immersion for 15 minutes in white spraying oil at a concentration of 1 : 60 proved satisfactory, but red oil, tested at various concentrations, was only moderately effective. Encouraging results were given by immersion in a diluted kerosene emulsion prepared by churning 2 gals. kerosene in a hot solution of ½ lb. soap in 1 gal. water. Immersion for 15 minutes in 1 part emulsion diluted with 20 parts water was most satisfactory. An emulsion of creosote (1 : 50), prepared in the same

way, and a proprietary creosote emulsion gave inconsistent results, while immersions in solutions of copper sulphate, nicotine sulphate, formaldehyde or Condy's crystals gave very low mortalities. Immersion in boiling or nearly boiling water gives satisfactory mortality, and although immersion for 15 minutes in water at 140°F. kills the weevils, the water should be maintained as near as possible to boiling point when large numbers of bags are to be treated. Immersion in a proprietary arsenical sheep dip, at the strength prescribed for dipping sheep, was tried for periods of 10 and 60 minutes, but all the weevils recovered.

The dusts were tested by mixing them at varying rates with uninfested wheat to which 50 weevils were added. Counts were taken at fixed intervals and the mortality noted. With two exceptions, the dusts were ground so as to pass through a 200-mesh sieve. Inconsistent results, including some highly satisfactory kills, were given by 1 per cent. ground quartz. Diatomaceous earth, calcined and ground in a mortar until the size of 90 per cent. of the particles was below 10μ and used at rates of 1–0·0625 per cent. by weight gave percentage mortalities of 90–100 in 7 days. Freshly calcined magnesite gave 100 per cent. mortality in 7 days, but its effectiveness decreased as it recombined with moisture. Fairly good results were given by rock phosphate and by a soft type of magnesite, but those from the residue from roasted iron pyrites were variable. Borax was inferior to several other dusts, and common salt was quite ineffective.

The best results are obtained when the dust is mixed with the wheat before it becomes infested and consequently damp. To test whether the number of weevils introduced into an uninfested sample affected the efficiency of the dust, 50 weevils were placed in 200 gm. wheat and 400 in 60 gm. Diatomaceous earth was used at 0·25 and 0·125 per cent., but no significant differences were obtained, 90–100 per cent. mortality resulting in all cases within 7 days. The mortality given by 0·5 per cent. diatomaceous earth was not reduced significantly by the admixture of up to 8 per cent. by weight of dust sifted from badly infested wheat, but treatment with an inert dust should be used to prevent rather than control infestation ; it was shown that it did not prevent the emergence of further weevils from infested grain.

DUMBLETON (L. J.). **How to Distinguish between the Grass Grub and the Subterranean Grass Caterpillar.**—*N.Z. J. Agric.* **62** no. 3 pp. 180–183, 10 figs. Wellington, N.Z., 1941.

The most serious pests of improved pastures in New Zealand are the grass grub, *Odontria zealandica*, White, and subterranean grass caterpillars of the genus *Oxycanus* (*Porina*) [*cf. R.A.E.*, A **29** 89], of which the most injurious is probably *O. cervinatus*, Wlk. All stages of both insects, except the eggs, are figured and briefly described.

Adults of *Odontria zealandica*, which injure cruciferous crops and the foliage of fruit and other trees, appear about the middle of November and are often attracted to light in large numbers. Larvae of this Melolonthid, which hatch in about a fortnight, are present in the soil from December until late September or early October and feed on the roots of grasses and clover, but they also develop in fallow ground if there is sufficient humus in the soil. They do not form definite tunnels in the soil, but, when numerous in pastures, cause the ground to become spongy by loosening the soil round the grass roots. Both

larval feeding and this loosening of the soil kill the plants. Brown patches of dying grass are characteristic of an attack in its early stages and are usually apparent in March or April. Pastures and crops are sometimes damaged within the first year of sowing. Consolidation of the ground by rolling or trampling by stock to allow the grass to root again is the only recommendation where extensive areas are involved, but small areas can be treated, when the grass is dry, by scattering over them a mixture of 1 lb. lead arsenate and 14 lb. fine dry soil or sand, this quantity being enough for 100 sq. ft. One treatment prevents infestation for about five years. The treated area can be topdressed in the spring with equal parts of superphosphate and ammonium sulphate at the rate of 1 oz. per sq. yd.

The larvae of *Oxycanus cervinatus*, which hatch in about a month, are present from late November onwards, and for the first month feed under a silken web on the surface of the ground among the crowns of grass plants. Later the larva makes a vertical tunnel in which it shelters during the day, emerging at night to feed on the blades of grass. It is protected by a covered runway of soil and dead grass bound together with silken threads, these casts being a characteristic sign of infestation. Pastures are not seriously damaged until April or May. Pupation occurs within the tunnel towards the end of August, and the adult emerges about six weeks later. The damage is characterised by a thinning-out of the sward and not a dying-out of the grass as in the case of *Odontria*. Investigations on the control of *Oxycanus cervinatus* are still in progress, but promising results were given by a poison bait of 1 lb. Paris green and 25 lb. bran (mixed while dry) to which was added 8 lb. molasses dissolved in 3 gals. hot water. The bait should be moist, but not sloppy, and should be applied at the rate of 60 lb. wet bait per acre as soon as damage to the pasture becomes apparent.

Thomas (K. M.) & Krishnaswami (C. S.). **Little Leaf—a transmissible Disease of Brinjal.**—*Proc. Indian Acad. Sci.* **10** no. 2 Sec. B pp. 201–212, 2 pls., 8 refs. Bangalore, 1939. [Recd. 1941.]

A description is given of a virus disease of egg-plant (*Solanum melongena*) that causes a gradual diminution in the size of the leaves and the suppression of the reproductive phase in the plants in and near Coimbatore (Madras Presidency). It was first observed in 1937, destroyed about 50 per cent. of the crop in 1938, and also occurs in the white and purple varieties of *Datura fastuosa*. K. M. Smith in a letter to the senior author suggested that the virus should be termed *Datura* virus 2. It was transmitted by grafting from egg-plant to egg-plant, *D. fastuosa*, tomato, tobacco and *Solanum trilobatum*, but not by sap inoculation or through the seed. Experiments, the technique of which is described, were also carried out with various insects that are common on egg-plant in the field. The virus was transmitted by *Empoasca devastans*, Dist., from diseased to healthy egg-plant but not to tomato, and by *Eutettix phycitis*, Dist., from diseased to healthy egg-plant and to *Solanum xanthocarpum*, but not to chillies [*Capsicum*] or *D. fastuosa*. No transmission was effected by two or three species of *Aphis*, the Tingid, *Urentius echinus*, Dist., an unidentified thrips or the Coccid, *Phenacoccus insolitus*, Green (which was tested on tomato only). The only method of controlling the disease appears to be the destruction of all solanaceous weeds and the prompt removal of all affected plants.

Miller (N. C. E.). **Drywood Termite Attack on Sepetir.**—*Malay. Forester* **10** no. 1 pp. 23–25. Kuala Lumpur, 1941.

Several instances have been reported in Malaya of damage by insects, usually the drywood termite, *Calotermes domesticus*, Hav., to furniture made of sepetir (*Sindora* spp.). The differences between drywood and subterranean termites are briefly reviewed, and the damage done by *C. domesticus* is described. As sapwood is frequently included in the furniture, an experiment was devised for testing the relative susceptibility to attack of sapwood and heartwood of sepetir. Immature individuals of *C. domesticus* were confined within glass rings secured with plasticine between two pieces of sepetir wood each 15 mm. thick. Six pairs were composed of heartwood only and six of heartwood and sapwood. In the latter, the rings were so placed that they covered an area of each type of wood. The tests were begun in March 1939, and examinations made monthly when possible. The experiment was closed in November 1940, and a detailed examination of the wood in December showed that, when a choice was available, sapwood was definitely preferred. Where only heartwood was available, there were signs of superficial penetration in most cases, and in some there were cavities measuring about 14 by 3 mm. in the lower piece of wood. In all pairs, there were only shallow abrasions on the upper portion. The usual method of penetration was to excavate a pit, 10–15 mm. long, from one part of which a deeper tunnel started. It is suggested that the relatively slight damage done during the experiment indicates that, though sapwood is preferred to heartwood, neither form of sepetir is particularly palatable to the termite. It is stated in an editorial footnote, however, that this is not borne out by data collected by the Forest Department.

Adamson (A. M.). **The Geographical Distribution of Insect Pests.**—*Trop. Agriculture* **18** no. 3 pp. 43–47, 4 refs. Trinidad, 1941.

This paper is designed to outline some of the problems involved in the spread of destructive insects by commerce. Objections that are brought against plant quarantines are mentioned, and, for an impartial discussion of them, reference is made to a report [*R.A.E.*, A **22** 132] in which the validity of the general principles on which the plant quarantines of California are based, their efficiency and their relatively small adverse effect on commerce are demonstrated.

Insects are divided into groups according to their tendency to extend their range across natural barriers, *viz.* : species ranging widely by natural means, such as *Alabama argillacea*, Hb., the corn ear worm [*Heliothis armigera*, Hb.] and locusts ; species unavoidably dispersed by man, and so already of worldwide distribution, such as pests of stored products ; species the dispersal of which by man may be controlled ; and species apparently unlikely to extend their range. The history of legislation against introduced pests is reviewed. It falls into three periods : the first attempts at legislative action by a few governments between 1870 and 1900 ; the passing of legislation in most countries and progress in attempts to enforce it from 1900 to 1920 ; and the adoption of reasonably comprehensive and efficient systems of control in most of the advanced countries between 1920 and 1940. The ideal objective for any area enclosed in effective natural barriers is the exclusion of all foreign animals and plants, except those of which the importation is desired. In many areas this ideal is not far removed from

actual practice, owing to the extensive control exercised by governments over the entry of articles of all kinds. In most countries a general law empowers the authorities to restrict the importation of all kinds of articles, especially plants and crop products, and to control the movements of vehicles of commerce. An account is given of widely adopted procedures. It is concluded that the enforcement of measures against foreign insects has a relatively small adverse effect on commerce and on the liberties of the people. The safe introduction of planting material of the major crops of any area is effected by passage through a quarantine station. The technique is outlined. Attention is drawn to the added danger arising through air transport. The efficacy of modern methods of excluding foreign insects is discussed, and instances of recent introductions and of the eradication of insects from invaded territories are cited.

McDonald (J.). **Cyprus. Annual Report of the Director of Agriculture for the Year 1939.**—4 pp. Nicosia, 1940.

This report contains a brief section of entomological interest (p. 3), in which it is stated that experiments in 1939 with derris and rotenone dusts as a substitute for a spray of nicotine sulphate and soft soap for the control of Aphids in Cyprus were unsuccessful except at concentrations that were more costly than the nicotine-sulphate spray. Reference is made to investigations in progress on the practicability of using cold storage as a means of destroying Trypetids in oranges, lemons and pomegranates under conditions approximating those of a voyage to Ceylon. *Rodolia* (*Novius*) *cardinalis*, Muls., which is predacious on *Icerya purchasi*, Mask., was re-introduced into Cyprus during the year [*cf. R.A.E.*, A **28** 454] and appeared to have become established.

Benson (R. B.). **On the European Genera of the Fenusini and two unrecognised British Species (Hymenoptera Symphyta).**—*Proc. R. ent. Soc. Lond.* (B) **10** pt. 5 pp. 85–90, 8 figs., 9 refs. London, 1941.

This paper includes a key to the European genera of the Fenusini and notes on some of the genera and species including the three British members of the genus *Metallus* (*Entodecta*). These comprise *M. gei*, Brischke, which mines the leaves of wild and cultivated *Geum* and is sometimes a pest in gardens in southern England, and *M. albipes*, Cam., and *M. pumilus*, Klug, which mine the leaves of *Rubus*. *M. albipes* is here recorded for the first time from Britain, but it appears that it, and not *M. pumilus*, is the common pest on cultivated species and hybrids of *Rubus* there ; the British Museum has specimens of *M. albipes* reared from mines on Phenomenal berry, raspberry and blackberry, but has no food-plant record for the only two specimens of *M. pumilus*.

Miao (C. P.). **Study of some Forest Insects of Nanking and its Vicinity. Part III. Observations on the Gypsy Moth** (*Porthetria dispar* **L.).**—*Contr. biol. Lab. Sci. Soc. China* (Zool.) **13** no. 5 pp. 57–77, 14 figs. Shanghai, 1939. **Part IV. Observations on the Pine Moth** (*Dendrolimus punctata* **Walker**).—*Op. cit.* **15** no. 1 pp. 1–16, 8 figs. 1940.

In the first of these papers, which are parts of a series [*cf. R.A.E.*, A **27** 360 ; **28** 68], detailed descriptions are given of all stages of

Lymantria (*Porthetria*) *dispar*, L., with notes on its life-history in the district of Nanking, where the larvae feed on the leaves of oaks, *Prunus* spp. and *Liquidambar formosana*. Eggs laid in the laboratory in June hatched in March–April of the following year, and the larval, prepupal and pupal stages lasted 43–60, 1–3 and about 14 days, respectively.

The second paper contains full descriptions of all stages of *Dendrolimus punctatus*, Wlk., which causes serious injury to *Pinus massoniana* and also attacks *P. thunbergi* in the Nanking district. There were three generations a year in the laboratory, of which the eggs hatched in the second half of June, the first half of August and the first half of October, respectively, and winter is passed by the larvae under the bark.

GOURLAY (E. S.). **Fuller's Rose Weevil,** *Asynonychus* (*Pantomorus*) *godmani* **Crotch, in New Zealand.**—*N.Z. J. Sci. Tech.* (A) **22** no. 2A pp. 84A–85A, 1 fig, 3 refs. Wellington, N.Z., 1941.

The author reviews from the literature the world distribution, food-plants and control of *Pantomorus* (*Asynonychus*) *godmani*, Crotch, and states that in New Zealand, where it was not previously known to occur, he has taken adults of this weevil in the autumn, winter and early spring of the three years 1937–40 on buildings at Nelson, and in March 1940 at the bases of telegraph poles at Auckland. Several of the examples taken at Auckland appeared to be newly emerged. It is probable that the adults emerge in late summer, overwinter, and oviposit in spring.

DUMBLETON (L. J.). **Australian Parasites of** *Eriococcus coriaceus* **Maskell.**—*N.Z. J. Sci. Tech.* (A) **22** no. 2A pp. 102A–108A, 3 figs, 4 refs. Wellington, N.Z., 1941.

The author briefly reviews the attempted introduction into New Zealand of predacious insects for the control of the Coccid, *Eriococcus coriaceus*, Mask., which is a pest of *Eucalyptus* spp., particularly *E. globulus*. Of the four species recently introduced [*R.A.E.*, A **23** 439], only two, *Stathmopoda melanochra*, Meyr., and *Pseudoleucopis benefica*, Mall., have been liberated [*cf.* **26** 753] and it is not known whether they have become established. The egg, larva and puparium of *P. benefica* are described, and an account is given of the life-history of this Sciomyzid from material collected at Adelaide, South Australia. The females oviposit on *Eucalyptus* twigs infested by *E. coriaceus*, and the larvae feed on the contents of a female scale. It is not known whether development is completed on only one host. The puparium is affixed to the twig. Eggs and larvae were present at Adelaide on 6th November 1936, and several adults emerged between 18th November and 1st December. An undetermined Chalcidoid hyperparasite was reared from a puparium collected on 9th December. A number of puparia of *Pseudoleucopis* sp. were collected in February 1937 at Hobart, where they were associated with *Eriococcus coriaceus* on *Eucalyptus globulus*, and characters are given distinguishing these puparia and the resultant adults from those of *P. benefica* reared at Adelaide.

In addition, there are at least two Hymenopterous parasites of *E. coriaceus*. One is *Aphycus nigrivarius*, Gir., which was described in 1929 from Queensland and Victoria. The examples from Victoria were

reared from *E. coriaceus*. Another is an undescribed species of *Metaphycus*, of which a single adult emerged on 25th September 1936 from a half-grown example of *E. coriaceus* collected in Adelaide. Further adults emerged during the last week of November from male and female scales collected on 6th November near the Waite Institute. A number of black Chalcidoids, which were apparently hyperparasites and which were identified as the Elasmid, *Euryischia comperei*, Ashm., emerged from some material that had been isolated because it was parasitised by *Metaphycus* sp.

ARMITAGE (R. W.). **Further Note on the Cabbage Butterfly.**—*Vict. Nat.* **58** no. 3 p. 48. Melbourne, 1941.

In this further note on *Pieris rapae*, L., in Victoria [*cf. R.A.E.*, A **29** 290], attention is drawn to a statement in the Press that a supply of its parasite, *Pteromalus puparum*, L., has been imported from New Zealand and is to be released. There would appear to be no definite number of local broods of the butterfly each year as adults were seen on every sunny day from 4th August 1940 and eggs and larvae in all stages could be found at any time up to the end of May 1941. The larvae caused great damage to cabbage in one district, but honesty (*Lunaria*), although a cruciferous plant, was apparently not infested.

PESCOTT (R. T. M.). **Insect Pests of Cabbages, Cauliflowers and related Plants.**—*J. Dep. Agric. Vict.* **39** pt. 3 pp. 119–126, 12 figs., 2 refs. Melbourne, 1941.

This paper comprises a popular account of pests of cabbages and cauliflowers in Victoria and recommendations for their control. They comprise snails and slugs and the mites, *Penthaleus major*, Dug., and *Halotydeus destructor*, Tucker, which are pests of the seedlings, and *Plutella maculipennis*, Curt., *Pieris rapae*, L. (which has recently been introduced [*cf.* preceding abstract]), *Brevicoryne brassicae*, L., *Listroderes obliquus*, Gylh. (*costirostris*, auct.), and cutworms, which attack the growing plants.

P. major and *H. destructor* are serious pests of seedling vegetables and other plants throughout Victoria, particularly on the sandy areas south and south-east of Melbourne. Their feeding causes silvering of the leaves, but once the plant is growing strongly it does not appear to suffer severe damage. In seedlings, the entire plant may be killed early, the result often being mistaken for frost injury. In some instances silvering of the foliage is not very pronounced, but dwarfing of the plant occurs similar to that produced by drought. Eggs are deposited on the lower surfaces of the leaves and on the ground. Seedlings should not be obtained from gardens known to be infested, and a grower raising his own should carefully prepare the seedbed and allow no growth of any kind on it for some weeks prior to sowing. Recommendations for control include dusting young plants with a mixture of derris powder and a 2 per cent. nicotine dust (1 : 8), or spraying the plants and soil under them with 1 oz. nicotine sulphate and 3 oz. soap in 5 gals. water. Applications should be made every three or four days as long as the mites are present.

Adults of *L. obliquus* frequently cut off young plants at ground level while the larvae attack older plants, damaging the outer leaves and

heart. The elimination of weeds prior to planting is an important factor in reducing the population of the weevil. As soon as the first signs of damage appear, plants should receive a dust containing 25 per cent. lead arsenate or 20 per cent. calcium arsenate, or a spray of 1 lb. lead arsenate in 16 gals. water. One application should be sufficient, but if subsequent damage is noticed the treatment should be repeated. Immersion of young plants in a lead-arsenate suspension prior to planting out reduces damage by *L. obliquus* and also by cutworms.

EVANS (J. W.). **Pasture-eating Dung Beetles.**—*Tasm. J. Agric.* **12** no. 1 pp. 28–30, 5 figs. Hobart, 1941.

An account is given of the bionomics of dung beetles of the genus *Aphodius* that in recent years have become a serious pest of pasture in Tasmania, and the identity of the species injurious in south-eastern Australia and Tasmania is discussed in an appendix. D. C. Swan in a paper already noticed [*R.A.E.*, A **22** 447] recorded specimens identified by A. M. Lea as *A. hqwitti*, Hope, from South Australia, but adopted the view of the Division of Entomology of the Council for Scientific and Industrial Research that this species is identical with *A. tasmaniae*, Hope. The author agrees with R. Paulian that the two species can be separated by differences in the morphology of the head of the adults, which are described and figured. *A. tasmaniae* occurs in southern Tasmania and has been bred only from larvae collected at Gretna and Huon Island. *A. howitti* has been bred from larvae collected at several places on the north-west coast and in Flinders Island, and is the injurious species in Victoria [**26** 85], South Australia [**22** 447] and probably New South Wales [**26** 209; **29** 335].

In Tasmania, the adult beetles appear in late January or early February and, after pairing, bury themselves in the ground. Eggs are deposited in earthen cells in groups of 30–40 and hatch in late February or early March. If the soil is relatively dry at this time, the larvae feed on roots, but as soon as the soil becomes moist enough, they make more or less vertical tunnels in it and emerge at night to feed on surface vegetation and, if it is available, on dung. If they find dung, they remain in it until it has all been eaten. They become fully fed in late August or in September, and the pupal stage, which is passed in the soil, lasts from early December until late January. Emergence of the adults from the soil appears to depend on an external stimulus, possibly heavy rain, which would moisten the soil and facilitate tunnelling to the surface.

The increase in numbers during recent years is probably associated with the development of improved pastures and the consequent heavy stocking and accumulation of dung, which was the preferred food in laboratory experiments, although larvae were also reared exclusively on grass. Larvae may be present in large numbers from March onwards, but are rarely noticed until May, when the piles of freshly-turned soil round the openings of their tunnels become evident. The principal damage is done in June and July, when, in addition to the destruction of the surface grass and clover, the soil surface may be covered with loose soil to a depth of an inch. Little or no permanent injury results, however, even after heavy infestation for two consecutive winters.

Infestations on lawns can be controlled by applying a spray containing 6 lb. lead arsenate in 100 gals. water or a 50 per cent. lead-arsenate dust. Preliminary experiments with poisoned bran baits for use on pastures have given promising results.

PUTMAN (W. L.). **The Feeding Habits of certain Leafhoppers.**—*Canad. Ent.* **73** no. 3 pp. 39–53, 8 figs., 30 refs. Guelph, Ont., 1941.

The feeding habits of certain Jassids are of particular importance, both because of the diverse nature of the injury produced by different species, and also because a number of them are vectors of plant viruses. An investigation was therefore undertaken in Ontario to ascertain the nature of the injury within the food-plant, especially the particular tissues fed upon and their relation to the external symptoms, and to determine any features of the ways of feeding that might bear some relation to the transmission of viruses. Details are given of the methods of study and the results obtained.

The following is based on the author's summary. *Typhlocyba pomaria*, McAtee, which produces white mottling of foliage typical of members of the subfamily TYPHLOCYBINAE, feeds in the palisade layers of the mesophyll of apple leaves. The cells are punctured and their contents removed after cytolysis by the saliva, which appears to act only on the cells into which it is injected and does not diffuse through the tissues. Vascular tissue appears to be only accidentally penetrated. A stylet sheath, apparently of salivary origin, is deposited along the outer part of the stylet track. The feeding habits of *Empoasca fabae*, Harr., on apple are similar to those on other food-plants [*cf. R.A.E.*, A **19** 687], feeding being confined chiefly to the phloem, although xylem and other tissues are occasionally penetrated. *Macropsis trimaculata*, Fitch, the vector of peach yellows and little peach viruses, feeds primarily in the phloem of peach and plum twigs and petioles. Considerable feeding is also done in the cambium, and the xylem is occasionally penetrated. The path of the stylets is chiefly intracellular and lined with a well-defined stylet sheath. The feeding habits of *M. insignis*, Van Duzee, on the same plants are identical with those of *M. trimaculata*.

It is concluded that the feeding habits of virus-transmitting leafhoppers do not show any special features, but are of the generalised phloem-penetrating type that is apparently the primitive condition in Jassids and among Homoptera in general. Members of the subfamily TYPHLOCYBINAE, in which the more specialised habit of feeding in the mesophyll has been evolved, do not appear to be concerned with virus transmission.

SMITH (H. S.). **Racial Segration in Insect Populations and its Significance in Applied Entomology.**—*J. econ. Ent.* **34** no. 1 pp. 1–13, 30 refs. Menasha, Wis., 1941.

The author discusses the development of races within species of economic insects, particularly those differing in physiological rather than morphological characteristics, and reviews the evidence for racial segregation within populations on the basis of the assumption that the fate of individual genetic variants is determined largely by environmental selection. It is possible that under the influence of cultural

practices, insect species may develop new races within the lifetime of an individual entomologist: they are maintained distinct solely because interbreeding is reduced by their separation in time or place, whereas species are maintained distinct because they cannot normally interbreed, even when they occur together, and it is the development of mechanisms to make interbreeding difficult or impossible that may make the evolution of species require time on a geological scale.

Examples are given of apparent race formation in insect populations due to the application of insecticides, or a preference for certain food-plants or hosts. The appearance of *Cydia* (*Carpocapsa*) *pomonella*, L., as a major pest of walnuts in California since 1918, though it had previously only severely attacked pome fruits [*cf. R.A.E.*, A **24** 157], may be due to the development of a race with a life-cycle synchronised with the seasonal development of the new food-plant, which becomes susceptible to infestation rather later in the season than apple. The occasional outbreaks that occur on walnut are presumably due to spread of the original race from other food-plants and do not necessarily recur in consecutive years. *Macrocentrus ancylivorus*, Rohw., a parasite of the oriental fruit moth [*Cydia molesta*, Busck], is believed to have occurred in parts of the United States as a parasite of the strawberry leaf-roller, *Ancylis comptana*, Froel., before the introduction of *C. molesta*, but only the race that came originally from New Jersey seems to give reliable control of the latter.

The practical significance of racial segregation is discussed with respect to control by means of insecticides, by biological or mechanical methods or by the breeding of resistant food-plants, and with regard to plant quarantine [*cf.* **29** 222]. The need for basic information on the nature and origin of races in insects is emphasised.

SHAW (F. R.). **Bee Poisoning: a Review of the more important Literature.**—*J. econ. Ent.* **34** no. 1 pp. 16–21, 46 refs. Menasha, Wis., 1941.

The author briefly reviews a considerable number of papers on the poisoning of honey bees by insecticides. In view of a report that sulphur, applied as a dust or in sulphide sprays, caused pronounced dysentery, with some mortality under experimental conditions [*R.A.E.*, A **22** 36], preliminary tests were carried out in which bees were fed on wettable sulphur, added to a 50 per cent. sugar solution at a rate equivalent to 5 lb. per 100 U.S. gals. water. Some mortality occurred, but many of the bees that fed three times on the mixture were alive 14–18 days later. They preferred plain syrup to sulphur syrup when given the choice, but when given the sulphur syrup alone consumed it readily. Wettable sulphur dusted lightly over combs containing unsealed brood caused considerable mortality when the particles entered the cells to such an extent that they could be seen on the larvae, and eggs failed to hatch if small amounts of sulphur were present in the cells. The addition to orchard insecticides of a material that would repel bees has been recommended [**20** 383], and preliminary experiments with a number of possible repellents used in combinations of spray materials or dusts such as might be applied under orchard conditions indicated that these materials decreased the number of visits made by the bees, as compared with those to untreated blossoms, but some of them injured the blossom. Further studies are necessary to determine

the effect of the repellent, alone or in combination, on the plant, and the duration of repellency, and to find repellents that will mix readily with sprays or dusts and remain well distributed.

BERTHOLF (L. M.) & PILSON (J. E.). **Studies on Toxicity to Honeybees of Acid Lead Arsenate, Calcium Arsenate, Phenothiazine, and Cryolite.**—*J. econ. Ent.* **34** no. 1 pp. 24–33, 4 figs., 16 refs. Menasha, Wis., 1941.

The following is substantially the authors' summary. Various insecticides that are used in the United States for the control of the codling moth [*Cydia pomonella*, L.] were used in toxicity tests against the honey bee, in the hope of finding one that is harmless to bees. Weighed amounts of acid lead arsenate, calcium arsenate, phenothiazine [thiodiphenylamine] and cryolite were finely suspended in measured volumes of 60–65 per cent. sucrose syrup, and measured volumes of these suspensions were then fed to bees individually in a single dose by the capillary pipette method. After being fed, the bees were confined in cages, given an adequate supply of sugar syrup, and placed in an incubator at 83–85°F. for three days, the number dead at the expiration of that time being used as a measure of toxicity.

When ordinary commercial insecticides, unclassified as to particle size, were used, calcium arsenate proved practically as toxic as soluble arsenic pentoxide, but lead arsenate was much less toxic, the median lethal doses of the two arsenates being approximately 0·6 and 13·4 micrograms of arsenic (As) per bee, respectively. Phenothiazine was scarcely toxic in doses up to 570 micrograms per bee. When materials of different particle size were used, the fine fractions were, on the whole, more toxic than the coarse. All sizes of calcium arsenate particles proved, however, more toxic than the finest lead arsenate. Cryolite was fairly toxic, but phenothiazine, although somewhat inconsistent in its action, seemed to be virtually non-toxic in all dosages commonly used. The median lethal doses of the arsenicals and of cryolite, in micrograms of active ingredient per bee, were calcium arsenate (As), fine and medium 0·7, commercial 0·6, coarse 1·3 ; acid lead arsenate (As), fine 5·0, commercial 13, coarse 185 ; synthetic cryolite (F), fine 4·2, medium 5·5, coarse 13·0. The median lethal doses for calcium arsenate are of less value than those for the other insecticides, as it is not a chemically pure compound and varies considerably in composition.

From these laboratory experiments it appears that phenothiazine in fine or medium particles and, to a less degree, coarse acid lead arsenate, meet the requirements for an insecticide against *C. pomonella* that is non-poisonous to bees [*cf. R.A.E.*, A **27** 528]. The practicability of the use of phenothiazine in the field remains to be determined, and if field tests show the desirability of continuing to use lead arsenate, the problem may be solved by the use of a coarser form of this material.

HOFFMANN (C. H.). **Biological Observations on *Xylosandrus germanus* (Bldfd.).**—*J. econ. Ent.* **34** no. 1 pp. 38–42, 2 figs., 3 refs. Menasha, Wis., 1941.

An account is given of studies carried out in New Jersey in 1939 on the bionomics of the introduced ambrosia beetle, *Xyleborus* (*Xylosandrus*) *germanus*, Bldf. [*cf. R.A.E.*, A **20** 430], which has been observed to breed in elm in the United States and is suspected of being a vector of *Ophiostoma* (*Ceratostomella*) *ulmi*, the fungus that causes Dutch elm

disease [*cf.* **26** 325]. It usually attacks unhealthy and weakened trees, wind-broken branches, logs and stumps, the heaviest infestation occurring in the field in partly submerged elm branches and in roots of elm stumps in moist situations, but two instances of attacks on healthy trees in heavily infested localities are recorded. It was found in elm material in New York, New Jersey, West Virginia and Ohio, and also in oak, red maple, beech and hickory in New Jersey. The females construct irregular brood burrows in the wood, both with and across the grain, sometimes penetrating to a depth of about an inch, and the wood round the burrows is stained blue or black. They were observed flying and entering suitable material, chiefly the roots of elm stumps treated with copper sulphate, in New Jersey on 10th May, and some of the roots were isolated for rearing. Most of the galleries made in spring are in previously uninfested wood, but some are formed beside old galleries containing overwintering adults. Each female oviposits for about three weeks, but contains only one mature egg at a time, so that all stages of the insect may occur together in a burrow. The eggs are laid in small loose groups, and the larvae feed on the ambrosia fungus in the burrow. The prepupal stage lasts 2–3 days, 22 females lived for an average of about 27 days, and the life-cycle appears to last 4–5 weeks. There was usually one male in each burrow, but occasionally two were present. The males do not fly, and they presumably fertilise the females before these leave to form new burrows. Under field conditions in New Jersey, all stages of *X. germanus* are present in brood burrows from June to September, but adults predominate by September. Many females overwinter in the burrows in which they emerge, but irregular chambers containing 15–200 females were found in elm material examined in November. Attempts to infest material artificially were unsuccessful ; moisture did not appear to be the only factor necessary for breeding, and it is possible that the wood must be in a certain condition of fermentation. There appear to be two annual generations or possibly three in New Jersey.

West jr. (A. S.). **Biological Notes on two Species of** *Melanophila*.— *J. econ. Ent.* **34** no. 1 pp. 43–45, 3 figs., 6 refs. Menasha, Wis., 1941.

Recent investigations on the Buprestids, *Melanophila gentilis*, Lec., and *M. californica*, Van Dyke, in ponderosa pine [*Pinus ponderosa*] and Jeffrey pine [*P. jeffreyi*] in north-eastern California have revealed striking differences in the larval development of the two species. Both overwinter as prepupae in bark cells, and they pupate and emerge at similar times in spring and summer. The adults fly spasmodically and feed on the needles of the food-plant before attaining sexual maturity ; they mate and oviposit on warm sunny days. The eggs are laid in crevices in the bark, and the newly hatched larvae mine through the bark to the region of the cambium. The larvae of the two species cannot be separated morphologically, but they can be distinguished in the field by the appearance of their galleries. The larvae of *M. gentilis*, which has a life-cycle of one year, develop rapidly in dead or dying material, chiefly slash and windfalls. The young larvae form small galleries in the cambium region, causing no mechanical injury to the wood, and then feed outwards through the phloem. Those of *M. californica*, which has a life-cycle of 2–5 years, pass through an incipient stage of slow growth in living wood for 1–4 years. Galleries are formed that heal over as long as the tree is alive, both phloem and wood being injured. Eggs are also laid in

slash and windfalls, but larvae from these do not survive the winter. A phase of rapid larval growth, corresponding to that of *M. gentilis*, with the formation of typical galleries in the phloem, is associated with the death of the wood as a result of logging, windfall, attack by other insects or other environmental disturbances. It is, therefore, possible for adults of both species to emerge from a single piece of material during one season. Incipient attacks by *M. californica* are usually relatively unsuccessful in vigorous trees, but more abundant broods of larvae of varying age are common in weaker trees.

FURNISS (R. L.) & DOWDEN (P. B.). **Western Hemlock Sawfly, *Neodiprion tsugae* Middleton, and its Parasites in Oregon.**—*J. econ. Ent.* **34** no. 1 pp. 46–52, 6 refs. Menasha, Wis., 1941.

The following is based largely on the authors' summary. Stands of western hemlock (*Tsuga heterophylla*) near Sweet Home, Oregon, were seriously defoliated by *Neodiprion tsugae*, Middleton, during 1933–36. Since the larvae feed chiefly on old foliage, few trees died. There is one generation a year in Oregon. Adults emerge and deposit eggs in hemlock needles early in the autumn, the eggs hatch early in the following July, and the larvae spin their cocoons in August or September. Most of the cocoons are spun in the forest litter, but a few are fastened to foliage. A small proportion of the population overwinters as prepupal larvae in cocoons.

During 1935 and 1936, large numbers of cocoons were collected for rearing. Parasites emerged from about 39 per cent. of the cocoons in both collections, but dissections of cocoons in 1936 showed that about 61 per cent. of the sawfly larvae had been killed by parasites. A list is given of the 20 species of primary parasites and hyperparasites that emerged, with brief notes on the bionomics of most of them. *Pimpla* (*Itoplectis*) *montana*, Cush., was one of the most important primary parasites reared in 1935, when most of the cocoons were collected on the foliage. *Exenterus tsugae*, Cush., *Microcryptus* (*Aptesis*) *tsugae*, Cush., *Stylocryptus subclavatus*, Say, and *Tritneptis klugi*, Ratz., were more important in 1936, when most of the cocoons were collected from the forest litter, but *T. klugi* was more often a hyperparasite than a primary parasite. *Delomerista diprionis*, Cush., was one of the most important species in both years.

Pimpla montana was liberated at two points in Connecticut, one in Massachusetts and one in New York where there were infestations of spruce by *Gilpinia* (*Diprion*) *polytoma*, Htg. Laboratory experiments indicated that it does not develop normally as a parasite of *G. polytoma*, but it is an important enemy of several Lepidopterous defoliators on the Pacific coast and might be generally valuable in the north-eastern forests. *Delomerista diprionis* was liberated in one district in New York and two in Connecticut against *G. polytoma* and at one point in New Jersey against *Neodiprion sertifer*, Geoffr.; it has, however, already been recorded in the north-eastern United States and in Canada.

WOLCOTT (G. N.). **The Establishment in Puerto Rico of *Larra americana* Saussure.**—*J. econ. Ent.* **34** no. 1 pp. 53–56, 8 refs. Menasha, Wis., 1941.

Much of the information here given on the distribution of the Porto Rican mole-cricket, *Scapteriscus vicinus*, Scud., and its Sphegid

parasite, *Larra americana*, Sauss., and on attempts to introduce the parasite into Porto Rico from Brazil in 1936–38 has already been noticed [*R.A.E.*, A **27** 85; **28** 414]. Tests carried out in bulk shipments in May and June, 1938 and 1939, to determine what factors besides the presence of living hosts might be essential for the survival of the parasite during the journey showed that survival was normal in the absence of food (powdered sugar syrup inside the lid of the box) but dropped to 65 per cent. in the absence of flowers of *Borreria verticillata*. Attempts to pack the hosts so that their odour should not reach the parasites, or so that they should be silent during the journey (by placing them in individual tins), had no effect on the survival of *L. americana*, but all of the latter died in a shipment containing moist sand previously inhabited by the crickets and foul with their excrement and dead bodies, but no living hosts. Parasites liberated in May and June 1938 and earlier in Porto Rico were established at two points by January 1939, but liberations in six other places in May and June 1939 resulted in establishment at only one point, possibly on account of the less luxuriant growth of *B. verticillata*, and its gradual elimination on pastures. Soil appears not to be the controlling factor. The parasite was found only near the points of release until January 1941, when adults were seen on the flowers of *Hyptis atrorubens* and on those of *B. verticillata* growing at the edges of ploughed fields some miles from the points of liberation. It is suggested that farmers in the Isabela district should leave unploughed strips at the ends of fields to aid the establishment of *L. americana*.

Costas (L. A.). **The Effect of varying Conditions on Oviposition by *Trichogramma* on Eggs of Angoumois Grain Moths.**—*J. econ. Ent.* **34** no. 1 pp. 57–58, 3 refs. Menasha, Wis., 1941.

The results are recorded of observations on oviposition by the dark variety of *Trichogramma minutum*, Riley, in eggs of the Angoumois grain moth [*Sitotroga cerealella*, Ol.] in 5-inch petri dishes at a temperature (unless otherwise stated) of 80°F. With 500 eggs in a dish the average percentage parasitism increased progressively from 68·47 to 93·87 as the ratio of parasites to host eggs increased from 1 : 5 to 2 : 1. There was no instance of 100 per cent. parasitism. In further experiments, in which the numbers of parasites and host eggs were each 100, eggs were parasitised after being stored at 38°F. for 18 days, but slightly less so than soon after deposition. The average percentage parasitism was considerably higher in light (82·7) than in darkness (8·8), probably because of increased activity of the parasites rather than increased vision, since they are thought to find hosts by random movements, and at 80°F. (82·7) than at 68°(20), and was only 6 in eggs produced on wheat treated with sulphur and 1·1 in eggs exposed when they were 4 days old.

Lindgren (D. L.) & Dickson (R. C.). **Fumigation of Purple Scale with Hydrocyanic Acid.**—*J. econ. Ent.* **34** no. 1 pp. 59–64, 1 fig., 7 refs. Menasha, Wis., 1941.

Experiments were carried out in 1939 to determine the factors affecting the results of tent fumigation with hydrocyanic acid gas against *Lepidosaphes beckii*, Newm., a serious pest of *Citrus* in California and other parts of the world. A fumigation chamber was used for the

tests, and most of them were carried out with a concentration of 0·37 mg. HCN per litre space for 40 minutes at 75°F., but almost complete mortality of crawlers was obtained with 0·14 mg. per litre for 20 or 40 minutes (98·7 and 99·3 per cent., respectively) The Coccid was also easily killed early in the first and second moulting periods, in the second instar and from just after the second moult until the end of the period in which the main scale covering is laid down. Eggs in the first half of their development period were more difficult to kill than any other stage. Other stages relatively resistant to fumigation were the eggs in the second half of their development, the recently settled insects, those late in the first and second moulting periods and the mature egg-laying females. No protective stupefaction was observed when the lethal fumigation was preceded by sublethal fumigation for 5 minutes with 0·1 mg. per litre. Mature insects and insects just past the second moult were not all killed by a concentration of 0·92 mg. HCN per litre, which is the approximate average concentration obtained in the field with a schedule of 18 cc. per unit. At this concentration the mature insects were a little less resistant than those just past the moult. Both stages were more easily killed when preconditioned for 3–5 hours at 50°F. than when preconditioned at 75°, and more susceptible after being kept at 75° than at 90°. On the other hand, young eggs preconditioned at 90°F. were more easily killed than those preconditioned at 50° or 75°. Fumigation at 90°F. resulted in a higher mortality of mature scales than at 75°, but there was little difference in the mortality of scales just past the second moult, whether fumigated at 75 or at 90°F.

GRAYSON (J. M.) & SWANK (G. R.). **A Laboratory Method for testing Fumigants: Results with Methyl Bromide against the Firebrat.**—*J. econ. Ent.* **34** no. 1 pp. 65–67, 1 fig., 9 refs. Menasha, Wis., 1941.

The following is the authors' summary. A new method of laboratory fumigation is described. It employs the use of carefully weighed glass ampules for measuring exact quantities of the fumigant and is adaptable for mixtures of gases. The median lethal concentration of methyl bromide for *Thermobia domestica*, Pack, was determined as 1·65 mg. per litre by this method.

RITCHER (P. O.). **Methyl Bromide Fumigation for Destruction of the Strawberry Crown Borer.**—*J. econ. Ent.* **34** no. 1 pp. 67–72, 13 refs. Menasha, Wis., 1941.

The following is taken from the author's summary of experiments begun in Kentucky in 1940 on fumigation with methyl bromide at atmospheric pressure as a means for destroying all stages of the strawberry crown-borer (*Tyloderma fragariae*, Riley) in strawberry plants to be used for setting new patches. All adults, eggs and larvae were killed by exposure to minimum dosages of 2, 3 and 3 lb. methyl bromide per 1,000 cu. ft. for a 2-hour period within temperature ranges of 68–85°F. and 61–84°F. and at temperatures above 70°F., respectively. No injury to dormant plants resulted from a 2-hour exposure to 3 lb. methyl bromide per 1,000 cu. ft. at temperatures below 80°F. Non-dormant plants were uninjured by a 2-hour exposure to 2 lb., but were severely injured by 3- and 4-hour exposures to 3 lb. Fumigation of

dormant strawberry plants before 1st April with a dosage of 3 lb. methyl bromide per 1,000 cu. ft. of space for a 2-hour period at a minimum temperature of 70°F. is suggested.

CASSIL (C. C.). **Derris Residue on marketable Cabbage.**—*J. econ. Ent.* **34** no. 1 pp. 72–74, 3 refs. Menasha, Wis., 1941.

The following is based on the author's summary. Analyses were made of the derris residues on marketable heads of cabbage with four or seven wrapper leaves, which had been dusted at 7-day intervals with five applications of a mixture of derris and clay containing 1 per cent. rotenone. The effect of rain on the residue, the relative amounts of residue on three wrapper leaves and the quantity of derris residue resulting from a single application were also determined. Statistical calculations showed that, among 11,600 heads from a single acre, one head with four wrapper leaves might be encountered that would contain 73 parts per million of derris (0·525 grain per lb.).

LIVINGSTONE (E. M.) & SWANK (G. R.). **Methyl Bromide as a Fumigant for Pests of ornamental Plants.**—*J. econ. Ent.* **34** no. 1 pp. 75–76, 1 fig. Menasha, Wis., 1941.

An account is given of tests carried out in New Orleans with methyl bromide as a fumigant against nine Coccids, *Dialeurodes citri*, Ril. & How., and *Tetranychus telarius*, L. (*bimaculatus*, Harvey) on ornamental plants, a dosage of ½ lb. per 1,000 cu. ft. for 4 hours being used in most cases and the temperatures being from 84 to 93°F. The infested plants were placed in a fumigation chamber and an electric heater and fan turned on. The fan was run at low speed to avoid injuring the plants, and after about two hours the liquid methyl bromide was introduced into a pan just above the fan. Mortality was complete in all cases, and no subsequent infestations developed. Of 23 plants, a list of which is given, only *Hibiscus*, *Dracaena*, *Pothos wilcoxii* and *Chrysanthemum* were affected by the fumigant.

GOODHUE (L. D.) & SULLIVAN (W. N.). **Toxicity to the Housefly of the noncrystalline Constituents of Roots of** *Tephrosia virginiana*.—*J. econ. Ent.* **34** no. 1 pp. 77–78, 2 refs. Menasha, Wis., 1941.

The following is the authors' summary. Three fractions of the non-crystalline portion of *Tephrosia virginiana* resin have been prepared [*cf. R.A.E.*, A **29** 397], and the toxicity of each to the house-fly [*Musca domestica*, L.] has been compared with that of rotenone. The neutral-resin fraction, which comprises approximately 50 per cent. of the total extractives, has considerable toxicity, but the alkali-soluble portion (9 per cent.) and the oil (23 per cent.) are nontoxic. The nontoxic nature of the oil should be considered when judging the value of the root from total-extractive content. The two crystalline compounds, $C_{21}H_{22}O_4$ and $C_{22}H_{24}O_4$, which were isolated from the neutral resin [*cf. loc. cit.*], are nontoxic to the house-fly.

SULLIVAN (W. N.), MCGOVRAN (E. R.) & GOODHUE (L. D.). **Fumigating Action of a Mixture of Orthodichlorobenzene and Naphthalene applied by a new Method.**—*J. econ. Ent.* **34** no. 1 pp. 79–80, 7 refs. Menasha, Wis., 1941.

The following is based largely on the authors' summary. A new method of applying a mixture of naphthalene and orthodichlorobenzene

consists in rapidly volatilising a solution of naphthalene in ortho-dichlorobenzene by spraying it on to a surface heated to about 375°C. [707°F.]. House-flies (*Musca domestica*, L.) and nymphs and adults of the cockroach, *Periplaneta americana*, L., were exposed for 24 hours in a 216-cubic foot chamber into which 80 cc. of a solution of 30 gm. naphthalene per 100 cc. was introduced. The process of spraying took about eight minutes, and very little crystallisation of the naphthalene followed. After exposure, the insects were kept in conditions in which mortality of controls was negligible. All the flies were dead after 1 day, and 94·4, 99·4 and 99·8 per cent. of the adult cockroaches, and 53·6, 92·3 and 98·1 per cent. of the nymphs were dead after 1, 3 and 10 days, respectively. The use of this method offers promise for the control of certain household and other insects.

HANSBERRY (R.) & NORTON (L. B.). **Toxicity of several Nicotine Compounds to *Aphis rumicis* L.**—*J. econ. Ent.* **34** no. 1 pp. 80–83, 7 refs. Menasha, Wis., 1941.

The following is the authors' summary. In the most toxic group of nicotine compounds tested against *Aphis rumicis*, L., are included nicotine laurate, nicotine oleate, nicotine linoleate, nicotine stearate and nicotine naphthenate. Nicotine alkaloid with sodium oleate as a spreader is about equal in toxicity to these compounds. A second and less toxic division contains a group of compounds with good to poor wetting properties, namely, nicotine alginate, nicotine Aresket, nicotine caseinate and nicotine humate ; a group consisting of dodecyl nicotinium iodide, didodecyl nicotinium diiodide, dodecyl nicotinium bromide and didodecyl nicotinium dibromide, with excellent wetting and spreading properties ; and a group of double salts with saponin as a wetting agent. Insoluble nicotine compounds included the silico-tungstate, peat, reineckate, cuprocyanide, bentonite and resorcinol-formaldehyde. These had little or no toxicity to Aphids.

It is suggested that the first group of fatty and naphthenic acid combinations is the most efficient because of the combined toxicity of the alkaloid and the acid, the increase in efficiency due to the wetting and spreading power of the compound and an unknown activating or synergistic action.

APPLE (J. W.). **The Influence of Sodium and Calcium Chlorides on Toxicity of Nicotine to Eggs of *Musca domestica* L.**—*J. econ. Ent.* **34** no. 1 pp. 84–85, 1 fig., 9 refs. Menasha, Wis., 1941.

The following is substantially the author's summary. The toxicity of nicotine to the eggs of the house-fly [*Musca domestica*, L.] is noticeably altered when the alkaloid is in normal solutions of sodium or calcium chloride. The median lethal dose of nicotine in distilled water was $0{\cdot}517 \pm 0{\cdot}009$ per cent., as compared with $0{\cdot}405 \pm 0{\cdot}011$ per cent. in normal sodium chloride solution and $1{\cdot}273 \pm 0{\cdot}055$ per cent. in normal calcium chloride solution.

SWINGLE (M. C.), GAHAN (J. B.) & PHILLIPS (A. M.). **Laboratory Rearing of certain Leaf-eating Insects.**—*J. econ. Ent.* **34** no. pp. 90–95, 3 figs., 2 refs. Menasha, Wis., 1941.

The following is mainly the authors' summary. Laboratory method of rearing leaf-eating insects for use in toxicological studies and

oviposition and rearing cages that were inexpensive and permitted the rearing of the insects in relatively large numbers are described. Cages employing interchangeable units facilitated the rearing of the stock with a minimum of handling. A water fount, such as is used for watering young chicks, was useful for maintaining foliage in a fresh condition. The insects reared comprised *Plusia* (*Autographa*) *brassicae*, Ril., *Hellula undalis*, F., *Evergestis rimosalis*, Gn., *Plutella maculipennis*, Curt., *Phlyctaenia rubigalis*, Gn., *Hymenia recurvalis*, F. (*fascialis*, Stoll), *Pieris rapae*, L., *Diaphania hyalinata*, L., *Laphygma* (*Prodenia*) *eridania*, Cram., *Psara* (*Pachyzancla*) *bipunctalis*, F., *Diacrisia virginica*, F., and *Leptinotarsa decemlineata*, Say.

Swingle (M. C.), Phillips (A. M.) & Gahan (J. B.). **Laboratory Testing of natural and synthetic organic Substances as Insecticides.** —*J. econ. Ent.* **34** no. 1 pp. 95–99, 2 figs., 5 refs. Menasha, Wis., 1941.

The following is substantially the authors' summary. In laboratory tests of the toxicity of synthetic organic compounds and plant materials to insects attacking market-garden crops, a settling dust chamber was developed to apply the powdered samples to excised foliage. This duster facilitated the application and measurement of the dust deposit and permitted the removal of the unused dust from the cylinder into an oil filter. Sections of dusted foliage were confined in petri dishes with leaf-feeding larvae to determine the initial toxicity of the dust. Compounds giving high mortality with limited feeding were tested as fumigants in petri dishes by isolating the chemical from the larvae. Toxic materials other than fumigants were suspended in water and applied as sprays to potted plants. Larvae were confined on the sprayed plants by cylindrical wire-screen cages. Materials that were toxic in the petri-dish and screen-cage tests were applied as sprays to tender market-garden plants to determine their possible toxicity to foliage.

Moore (J. B.) & Fox (C. C.). *Lygus* **Injury to Peaches in the Pacific Northwest and its Prevention.**—*J. econ. Ent.* **34** no. 1 pp. 99–101, 2 figs. Menasha, Wis., 1941.

Cat-facing of peaches caused by Capsids of the genus *Lygus* [*cf. R.A.E.*, A **26** 444] caused very severe crop losses in 1938, 1939 and 1940. Cage tests in Washington in 1940 showed that three species, *L. elisus*, Van D., *L. hesperus* var. *viridiscutatus*, Knight, and *Lygus* sp., were responsible for the damage, which was caused only from the time that the pink began to show until the sepals fell. When applications of 40–50 lb. per acre of a dust consisting of 10 per cent. Dry Pyrocide in talc and containing 0·2 per cent. pyrethrins were made when the buds were in the pink stage, just after petal fall and after sepal fall, preferably at about sunrise, 98·3 per cent. of the picked crop of all varieties was free from *Lygus* injury, whereas only 45 per cent. of the total crop was uninjured in a neighbouring orchard. The third application of dust was probably unnecessary.

HUTSON (R.). **Field Spraying for Control of Grapeberry Moth.**—*J. econ. Ent.* **34** no. 1 pp. 102–105, 1 fig., 1 ref. Menasha, Wis., 1941.

. An account is given of spraying experiments carried out against *Polychrosis viteana*, Clem., in vineyards in Michigan during 1939 and 1940. The results obtained in 1939 have already been noticed [*R.A.E.*, A **29** 117]. In 1940, excellent control was obtained with five sprays [*cf. loc. cit.*], of which the first two, three or four contained calcium arsenate and the remainder nicotine sulphate or a fixed nicotine (Black Leaf concentrate). Control of the grape leafhopper [*Erythroneura*] was satisfactory, and was as good on plots receiving two or more applications of fixed nicotine as on those receiving nicotine sulphate, which is usually recommended against it. A schedule consisting of two sprays of 3 lb. calcium arsenate per 100 U.S. gals. before bloom, a similar spray after bloom and two of 3 lb. fixed nicotine per 100 U.S. gals. is recommended. A good wetting agent appears to be necessary in the applications at blooming time to ensure penetration of the webs of *Polychrosis* in the clusters. Owing to the need for controlling fungous diseases, all the arsenicals and the nicotine sulphate were applied in Bordeaux mixture (8 : 8 : 100 and 4 : 4 : 100, respectively), and the fixed nicotines, which are incompatible with Bordeaux mixture, with a proprietary copper fungicide of low solubility. The application of the last spray while the grapes were small apparently reduced the possibility of excessive residue at harvest.

FAHEY (J. E.). **A Study of Clays used in Preparation of Tank-mix Nicotine Bentonite Sprays.**—*J. econ. Ent.* **34** no. 1 pp. 106–108, 7 refs. Menasha, Wis., 1941.

The following is based on the author's summary and conclusions. Twenty-seven bentonite clays obtained from eleven States of the United States and two Canadian Provinces were studied with seven other absorbent materials to determine their value in the preparation of nicotine-bentonite sprays. Tests were made to determine their swelling value, whether or not suspensions prepared from them were flocculated by the addition of nicotine suphate, and the quantity of nicotine removed by them from water solution.

In general, the clays that removed a high percentage of nicotine from water solution showed characteristic swelling when wet with water and were flocculated from water suspension by the addition of nicotine sulphate. The principal exception was a bentonite obtained from Mississippi, which did not swell when wet with water and was not flocculated by nicotine sulphate, but did remove 93·1 per cent. of the nicotine from water solution. Spraying tests showed that the residues resulting from clays flocculated by nicotine sulphate were blotchy in character and more resistant in weathering than the spot-type residues deposited by clays that were not flocculated by nicotine sulphate.

It is concluded that bentonite clays suitable for the preparation of tank-mix nicotine-bentonite sprays should possess the following properties : when wet with water they should swell to the extent of at least 4 ml. per gm. clay ; they should be flocculated from water suspension by the addition of 1 gm. commercial nicotine sulphate solution (40 per cent. nicotine) to each 5 gm. clay ; and they should remove not less than 90 per cent. of the nicotine from water solution when mixed in the proportion of 1 gm. commercial nicotine sulphate solution (40 per cent. nicotine) to 5 gm. clay.

YOTHERS (M. A.) & CARLSON (F. W.). **Orchard Observations of the Emergence of Codling Moths from Two-Year-Old Larvae.**—*J. econ. Ent.* **34** no. 1 pp. 109–110, 1 fig., 3 refs. Menasha, Wis., 1941.

An apple orchard in Washington that had been heavily infested with *Cydia* (*Carpocapsa*) *pomonella*, L., in 1938 was found to contain many overwintered larvae at the bases of the trees at a depth of 1–3 inches in the soil and within 4 inches of the trunks during the first week in July 1939, when practically no larvae of the first generation had left the fruit, and large numbers of such larvae were still alive on 10th November. It was obvious that the larvae had overwintered, since hundreds were found under trees that bore practically no fruit in 1939 and the cocoons were tough, weathered and massed together like those from which adults had emerged in spring. The infested trunks were surrounded by wire cages in August 1939, and nearly a thousand moths, about 90 per cent. of which must have developed from larvae of the 1938 season, emerged in 1940. From this evidence, it appears that *C. pomonella* cannot be eradicated in a given orchard or district by the natural or artificial removal of the entire crop for a single season.

MOORE (J. B.), GNADINGER (C. B.), COULTER (R. W.) & FOX (C. C.). **Control of Pacific Mite and European Red Mite on Apples.**—*J. econ. Ent.* **34** no. 1 pp. 111–116, 4 refs. Menasha, Wis., 1941.

The results are given of tests in which Selocide, which is made by dissolving selenium in potassium ammonium sulphide solution [*cf. R.A.E.*, A **28** 185, etc.], was used against *Tetranychus pacificus*, McG., and *Paratetranychus pilosus*, C. & F., on apple in Washington. In one orchard, heavily infested with both mites and sprayed on 10th April 1940, counts made three and six weeks later showed a kill of 99·9 per cent. mites and eggs for each species, and infestation did not build up again during the summer. Successful control (96·5–98·9 per cent.) without reinfestation was obtained in other orchards infested with *T. pacificus* and sprayed in July or August, except in one in which the apples were probably reinfested from adjacent infested and unsprayed apricots. There was no injury to the trees, except some leaf-drop when spraying was carried out at a temperature of 105°F.

It was found that the soils in the Wenatchee district were high in natural selenium content, and the amount added by one application per year was negligible; that apples do not take up selenium from the soil; and that those from an orchard sprayed with the equivalent of a three years' spray schedule of Selocide contained no more than those from orchards that had never been sprayed with it. Comparisons of washed and unwashed apples from orchards sprayed with Selocide showed that washing to remove selenium residue was not necessary.

The authors recommend a spray of 1 U.S. pint Selocide Concentrate, 0·33 U.S. gals. medium summer oil (at least 90 per cent. unsulphonatable residue) and 0·167 lb. Spredite (Leffingwell potassium caseinate) in 100 U.S. gals. water; the spray should be applied thoroughly to all parts of the tree. Selocide cannot safely be mixed with lead arsenate or applied over lead-arsenate cover sprays; but lead arsenate can be used about a week after Selocide. It can be mixed with cryolite or sprayed over it, and has been used over lead-arsenate cover sprays successfully where at least one cover spray of cryolite has followed the

arsenate. It is compatible with nicotine and pyrethrum, but the spray recommended should not be applied within a month of a dormant spray of lime-sulphur because of the oil content.

HUFFAKER (C. B.). **Egg Parasites of the Harlequin Bug in North Carolina.**—*J. econ. Ent.* **34** no. 1 pp. 117–118, 4 refs. Menasha, Wis., 1941.

In mid-September 1939, *Ooencyrtus johnsoni*, How., and *Trissolcus murgantiae*, Ashm., were observed ovipositing in eggs of *Murgantia histrionica*, Hahn, in Raleigh, North Carolina, and collections of eggs were made to determine the effectiveness of the parasites in controlling the Pentatomid. The percentages of eggs unparasitised, parasitised by *O. johnsoni* and parasitised by *T. murgantiae* were 15, 37 and 48 on a crop heavily infested by the bug, and 31, 26 and 43 on one lightly infested, indicating that the parasites may give effective control before infestation becomes heavy. The ratio of females to males was 67 : 33 in *O. johnsoni* and 84 : 16 in *T. murgantiae*, in which species the distribution of the sexes was much more uniform. Multiple parasitism did not occur in *T. murgantiae* [*cf. R.A.E.*, A **25** 516]. Its life-cycle lasts 10–14 days under favourable conditions, that of *O. johnsoni* being somewhat longer [*cf. loc. cit.*].

HAWKINS (J. H.). *Septis* **Larvae attacking Wheat and wild Rice.**—*J. econ. Ent.* **34** no. 1 p. 118. Menasha, Wis., 1941.

Injury to wheat by the Noctuid, *Septis finitima*, Gn., has been observed repeatedly in Maine since 1927. The young larvae make small holes in the grains of the growing ears, and older ones eat part or all of the grains in the growing or mature ear. The larvae hide in the soil or near its surface when not feeding and have been found on sedge [*Carex*], timothy grass [*Phleum pratense*] and an ear of maize. There is apparently one generation in the year in Maine, the winter being passed in the larval stage. In outdoor cages filled with wheat straw, the larvae fed on mature grains in autumn until cold weather, when they hibernated under the straw, and on wheat grains and fresh wheat in spring until they pupated by 1st June. They did not feed on the foliage of various plants offered to them either in autumn or in spring. The adults are on the wing from the second week in June until toward the end of July.

Septis larvae that resemble those of *S. finitima*, but do not leave their food-plant for temporary shelter, have destroyed wild rice growing in streams and lakes in Maine to such an extent that wild duck, which use the rice for food and shelter, have practically abandoned breeding grounds in which they were once abundant. The larvae remain on the rice until frosty weather, when they migrate to the banks and hibernate in the soil.

KAGY (J. F.) & MCCALL (G. L.). **Dust Mixtures of a Phenol Salt for Control of Mites.**—*J. econ. Ent.* **34** no. 1 pp. 119–120, 3 refs. Menasha, Wis., 1941.

The dicyclohexylamine salt of 2-4-dinitro-6-cyclohexylphenol has certain physical and chemical properties that make it more suitable for use in insecticide mixtures than the parent phenol and certain of its organic and inorganic salts. Laboratory studies showed that

was nearly as toxic to *Paratetranychus citri*, McG., as the phenol, when compared on the bases of equivalent weights of the latter, but its speed of action appeared to be rather less. However, because of its low vapour pressure, its residual action is more prolonged under definite temperature conditions, and dust mixtures containing it were shown to be safer on *Citrus* and other plants. Large-scale field tests in California showed that a dust containing about 1·7 per cent. of the salt was as effective as one containing 1·0 per cent. of the phenol (DN Dust) against *P. pilosus*, C. & F., *Tetranychus telarius*, L., *T. sexmaculatus*, Ril., *T. pacificus*, McG., and *Bryobia praetiosa*, Koch, and the added safety at high temperatures made it possible to control mites on many plants that would not tolerate DN Dust. Dust mixtures containing the salt were very toxic to *Scirtothrips citri*, Moult., *Heliothrips haemorrhoidalis*, Bch., and *Hercothrips fasciatus*, Perg. They were toxic to crawlers of *Aonidiella aurantii*, Mask., protecting plant surfaces from their settling for longer than DN Dust, and to *Saissetia oleae*, Bern., killing the young when applied within two weeks after they had settled on *Citrus* leaves. Laboratory tests showed that both dusts and sprays containing the salt were effective against *S. oleae*; petroleum oil can be used as an adhesive in water dispersions, forming inverted mixtures that can be used safely on *Citrus* foliage. As the salt is much less soluble in petroleum oil than the phenol, it can be used with the oil in dusts with less injury to foliage, and it is possible to control *P. citri* on lemon and orange with smaller dosages and also to control mites on certain deciduous fruits and other crops. Two new dusts that contain about 1·7 per cent. of the salt have been made available commercially under the names DN Dust D-4 and DN Dust D-8.

Boyce (A. M.) & Bartlett (B. R.). **Walnut Husk Fly Control Studies.** —*J. econ. Ent.* **34** no. 1 pp. 120–121. Menasha, Wis., 1941.

Since cryolites, of which the best is a natural cryolite containing 93 per cent. sodium fluoaluminate, approximately 95 per cent. of which has a particle size of not more than 5 microns, have not always given satisfactory control during recent years of *Rhagoletis suavis completa*, Cress., an important pest of walnuts over a limited but increasing area in southern California, laboratory and field tests were carried out with a number of other substances. Sprays and dusts of phenothiazine [thiodiphenylamine], a synthetic cryolite containing approximately 83 per cent. sodium fluoaluminate of a particle size of 1–3 microns, basic zinc arsenate, basic lead arsenate, and xanthone (Genicide) were less effective than the natural cryolite, and barium fluosilicate, cuprous cyanide and basic copper arsenate gave approximately equal control. Basic zinc arsenate and cuprous cyanide caused negligible injury to walnut foliage and xanthone moderate to severe injury. The inclusion of sucrose in sprays and dusts of natural cryolite increased their effectiveness greatly in the laboratory, but had no appreciable effect in the field. Basic copper arsenate with sucrose was more effective than natural cryolite with sucrose in the laboratory, and sprays containing 4 lb. arsenate and 8 lb. sucrose per 100 U.S. gals. were more effective than similar dosages of natural cryolite during two seasons in the field. Slight or moderate foliage injury occurred on several occasions. Tartar emetic was more effective than natural cryolite under laboratory conditions when applied as a spray with sucrose, but practically useless without. Limited laboratory tests showed no significant difference in

effectiveness when 2, 4 or 8 lb. sucrose was added to a spray of 4 lb. tartar emetic per 100 U.S. gals. ; laevulose or dextrose could be substituted for sucrose. In extensive field tests, however, sprays of 4 lb. tartar emetic and 8 lb. sucrose per 100 U.S. gals. gave practically no control, and the addition of tartar emetic and sucrose to natural cryolite in sprays or dusts did not increase control. Derris or cubé dusts containing 1 per cent. rotenone were very effective in the laboratory and caused appreciable mortality in the field, but three applications at intervals of 15 days did not give satisfactory control, and the addition of sufficient derris or cubé to natural cryolite dust to give a rotenone content of 1 per cent. did not increase its effectiveness.

Flock (R. A.). **The Field Roach** *Blattella vaga.*—*J. econ. Ent.* **34** no. 1 p. 121, 1 ref. Menasha, Wis., 1941.

The following is based on the author's summary. The field cockroach, *Blattella vaga*, Hebard, is quite common in the Lower Sonoran Zone in Arizona and occurs in California. It occasionally damages plants or is a nuisance in houses. This species is very closely related to *B. germanica*, L., and possibly represents an intermediate stage in the acquisition of domiciliary habits.

La Rivero (I.). **Response of** *Anabrus simplex* **to Temperature.**—*J. econ. Ent.* **34** no. 1 pp. 121–122, 1 ref. Menasha, Wis., 1941.

Observations made in June and July 1939 in northern Nevada showed that the optimum ground and air temperatures for the migration of the mormon cricket, *Anabrus simplex*, Hald., were 39 and 26°C. [102·2 and 78·8°F.], comparatively few individuals moving when they rose to 49 and 29°C. [120·2 and 84·2°F.], respectively. On the other hand, some migrated into the face of a cold wind when the temperature was only 6–9°C. [42·8–48·2°F.] two inches above the ground, and tests with seven adults showed that at an average air temperature of 2·89°C. [37·2°F.], at which they were still capable of slow movement, the average body temperature was 6·53°C. [43·75°F.].

Craig (F. W.). **Observations on the Periodical Cicada.**—*J. econ. Ent.* **34** no. 1 pp. 122–123, 1 fig., 1 ref. Menasha, Wis., 1941.

The author considers that injury caused to fruit trees and other woody plants by *Magicicada septendecim*, L., often endures over a period of years. He gives photographs, taken in 1940, of an apple twig found in West Virginia showing egg slits made by females of Broods V and XIV, which occurred in 1931 and 1940, respectively. It is evident that more than one brood may occur in one locality in numbers sufficient to do considerable damage, and areas of injury by these two broods were noted in several widely separated counties in the State. Heavy populations still occur in the places where they were originally observed, and new foci of abundance do not seem to have developed. The boundaries of the infestations are well defined, there seems to be little or no tendency to scatter beyond them, and the population, with resultant damage, is heaviest near the outer edge of the infestation. It is suggested that individuals that chance to fly away from the main brood are drawn back to it by the sound made by the males, which is always of greatest volume where the insects are concentrated.

DEAN (R. W.). **Attraction of** *Rhagoletis pomonella* **Adults to Protein Baits.**—*J. econ. Ent.* **34** no. 1 p. 123, 1 ref. Menasha, Wis., 1941.

A brief account is given of tests of decomposing protein baits [*cf. R.A.E.*, A **28** 468] in glass traps for *Rhagoletis pomonella*, Walsh, carried out in a heavily infested apple orchard in New York in 1940. Maximum captures in traps occurred three days after maximum emergence in cages, and females constituted 83·3 per cent. of the total numbers caught in traps, as compared with 59·5 per cent. of the number emerging in cages. The most attractive of the 16 baits tested was powdered egg albumin, used at the rate of 40 gm. (without lye) per litre water, which attracted an average of 3·7 females and 0·7 males per day per trap during a period of 25 days.

KNOWLTON (G. F.) & HARMSTON (F. C.). **Insect Food of the Chipping Sparrow.**—*J. econ. Ent.* **34** no. 1 pp. 123–124. Menasha, Wis., 1941.

A list is given of insects and Arachnids found in the stomachs of 41 specimens of *Spizella passerina arizonae*, collected during 1940 throughout Utah, where flocks were observed feeding on the sugar-beet leafhopper [*Eutettix tenellus*, Baker] on its breeding grounds.

MCDANIEL (E. I.). **Spraying to control** *Rhyacionia buoliana*.—*J. econ. Ent.* **34** no. 1 p. 125. Menasha, Wis., 1941.

Preliminary experiments against *Rhyacionia buoliana*, Schiff., on pine in 1940 showed that a fixed-nicotine spray consisting of 3 lb. Black Leaf 155 (14 per cent.) with 1 U.S. quart Dendrol dormant oil in 100 U.S. gals. water gave effective control. Under Michigan conditions, two applications, made about 30th June and 8th–10th July, were necessary.

PARKER (K. G.), READIO (P. A.), TYLER (L. J.) & COLLINS (D. L.). **Transmission of the Dutch Elm Disease Pathogen by** *Scolytus multistriatus* **and the Development of Infection.**—*Phytopathology* **31** no. 7 pp. 657–663, 8 refs. Lancaster, Pa., 1941.

An account is given of experiments in New York in 1936–40 on the transmission by *Scolytus multistriatus*, Marsh., of *Ophiostoma* (*Cerastomella*) *ulmi*, the fungus that causes Dutch elm disease. The following is substantially the authors' summary. *O. ulmi* was obtained from the outer surfaces of adults of *S. multistriatus* in a higher percentage than from their intestinal tracts. Likewise, the numbers of colonies in the cultures were much greater. Transmission of the fungus to potted healthy elm trees by the beetles in their feeding activities was readily obtained. The fungus was re-isolated from feeding wounds on uninfected trees as long as 3 years following inoculation. Infection was obtained on trees inoculated during the late spring and early summer. Inoculations made later in the season induced infection less frequently or not at all. There was evidence that the fungus sometimes died in infected trees. Sometimes the infected twig died without the entire tree becoming invaded.

SMITH (R. H.). **Common Names of the Scale Insect** *Saissetia nigra* (**Nietn.**).—*Bull. Dep. Agric. Calif.* **29** no. 3 pp. 125–127, 1 fig., 17 refs. Sacramento, Calif., 1940.

The popular names of *Saissetia nigra*, Nietn., in different parts of the world are reviewed. The one most commonly used is " black scale," but in California this is the name given to *S. oleae*, Bern. The application of the same popular name to the two species of scale insects* has been the cause of errors in entomological literature. In the *Review of Applied Entomology* there are a number [two] of citations [*R.A.E.*, A **9** 117 ; **17** 76] pertaining to the black scale on *Citrus* in California that have been indexed under *S. nigra* when the species in question was *S. oleae*.

With the spread and increase of *S. nigra* throughout the coastal region of California during the last 15 years [*cf.* **29** 114], the need for a name distinguishing it from *S. oleae* has arisen. In 1938, the author suggested the name " nigra scale," and recent reports indicate that this name is now widely used in nursery inspection services in California and Florida.

LINDGREN (D. L.) & DICKSON (R. C.). **Fumigation of Walnut Trees in Ventura County.**—*Bull. Dep. Agric. Calif.* **29** no. 3 pp. 146–151, 3 figs. Sacramento, Calif., 1940.

In connection with a project for eradicating *Aonidiella aurantii*, Mask., on *Citrus* in Ventura County, certain infestations in *Citrus* orchards were found to originate from infested walnut trees in the vicinity. Experiments were therefore made to determine the possibility of tent fumigation of large walnut trees with hydrocyanic acid gas. At the beginning of August 1939, six walnut trees at the Citrus Experiment Station were fumigated with dosages of 18 and 24 cc. HCN per unit. They varied in size from 65 to 80 units, the largest measuring 100 feet round and 70 feet over. No difficulty was encountered in covering the trees, while very good diffusion of gas was obtained and no tree injury appeared. The gas concentrations obtained at different intervals and different parts of the tents are shown in tables and graphs.

Experimental fumigation of walnut having proved successful, fumigation of walnut trees in Ventura County began in November 1939. Most of the trees fumigated could be covered with 75–80 foot tents : the large ones were difficult to cover as the tents weighed over 500 lb., but special derricks prevented them from tearing. A group of heavily infested trees were fumigated on 21st November with dosages of 18, 24 and 36 cc. per unit. Concentration studies on trees varying in size from 38 to 48 units confirmed the experimental results, indicating very good diffusion of gas within the tented enclosure. In December 1939 and January 1940, a group of large walnut trees infested with *A. aurantii* were fumigated with dosages of 18, 24 and 30 cc. per unit. The trees varied in size from 124 to 156 units, the largest being 138 feet round and 94 feet over, with a volume of 41,113 cu. ft. There was less leakage of gas from the large trees, because the ratio of tent surface to volume was less. No injury had appeared on any of the fumigated trees by July 1940.

* It may be of interest to note that the name "Black scale" is used in Palestine for a third species, *Chrysomphalus ficus*, Ashm. — *Ed.*

In most cases, the number of live scales on the walnut trees before treatment was small, while dead ones were numerous, so that the data on the effectiveness of the treatment were not conclusive. Five out of a total of 8,423 scales examined after a single fumigation were alive. One in the second moult was alive on a tree that had been fumigated with a 36 cc. schedule. No scales subjected to two fumigations were found alive, though 18,753 were examined.

STEINWEDEN (J. B.). **Citrus Thrips Damage on Chinese** *Photinia.*—*Bull. Dep. Agric. Calif.* **29** no. 3 p. 151, 1 ref. Sacramento, Calif., 1940.

During the early part of July 1940, *Scirtothrips citri*, Moult., was found damaging young leaves of a variety of *Photinia serrulata* in nurseries in central California. New growth was silvered and distorted, while many older leaves exhibited scars, particularly along the midribs. This appears to be the first record of *Photinia* as a food-plant of *S. citri*, and is possibly the first time that injury has been noted on ornamental plants, although the thrips occurs throughout the *Citrus* area of California. In August it was found damaging young leaves of Virginia creeper, *Parthenocissus* (*Ampelopsis*) *quinquefolia*.

M[ACKIE] (D. B.). **Cherry Fruit Flies in California. (A Preliminary Note.)**—*Bull. Dep. Agric. Calif.* **29** no. 3 p. 157. Sacramento, Calif., 1940.

During a survey of the distribution of cherry fruit-flies of the genus *Rhagoletis* in California, three adults of *R. fausta*, O.-S., were collected on *Prunus emarginata* at Sardine Springs in Nevada County. *R. fausta* was not previously known to occur naturally in California and is the object of a quarantine. The most common species on *P. emarginata* in California is, however, the one that appears to be identical with *R. cingulata*, Lw. [*cf. R.A.E.*, A **29** 222] and is shown to be native to the State by the fact that it is much parasitised by a species of *Opius*. Cultivated cherries growing within a few hundred yards of wild cherries showed no signs of infestation [*cf. loc. cit.*]. In California, this Trypetid prefers fairly high altitudes, ranging from 3,000 feet on the slopes of Mt. Shasta to more than 8,500 feet in the Sequoia National Park. Until further investigations have been carried out, no modification in the quarantine will be made.

KEIFER (H. H.). **Eriophyid Studies X.**—*Bull. Dep. Agric. Calif.* **29** no. 3 pp. 160–179, 16 figs. Sacramento, Calif., 1940.

This part of a series [*cf. R.A.E.*, A **27** 288] contains descriptions of 4 new genera and 16 new species of Eriophyids. One of the new species is *Phyllocoptes destructor*, which was taken on field and glasshouse tomatos in California in the summer of 1940. The mites feed on the leaves, stems and fruit, causing severe browning and curling of the leaves and russeting of the fruit. Characters are given distinguishing it from *P. lycopersici*, Massee [*cf.* **26** 103], which causes similar injury in Australia. Dusting with sulphur gave almost complete control in the greenhouse, and the subsequent development of the plants was normal.

Schoof (H. F.). **The Effects of various relative Humidities on the Life Processes of the southern Cowpea Weevil,** *Callosobruchus maculatus* **(Fabr.) at 30°C.,±0·8°.**—*Ecology* **22** no. 3 pp. 297–305, 2 figs., 10 refs. Lancaster, Pa., 1941.

The following is substantially the author's summary. Experiments in North Carolina on the life processes of the southern cowpea Bruchid, *Bruchus* (*Callosobruchus*) *maculatus*, F., at 30±0·8°C. [86±1·44°F.] and various relative humidities showed that that it is euryhygric at this temperature. Humidities of 0–21 and 80–90 per cent. increase both the mortality and the duration of the egg stage, optimum humidity being between 44 and 63 per cent. Insects in the larval-pupal stage (considered as a unit since both larval and pupal stages occur within the cowpea and so cannot be studied separately) develop most rapidly at 80 per cent. humidity. Approximately equal percentages of adults emerge at humidities of 0–80 per cent., but at 91 per cent. the mortality is increased. Humidities of 0–21 per cent. possibly have some effect on the mortality of the larval-pupal stage, but because of the impossibility of hatching eggs under normal conditions (44 per cent. humidity) and then transferring the newly-hatched larvae to cowpeas already in equilibrium with these humidities, this effect cannot be shown. The duration of the egg, larval and pupal stages, considered as a unit, decreases as the humidity increases, with most rapid development at 91 per cent. Optimum humidity for survival is approximately 44 per cent. Cowpeas transferred from one humidity to another temporarily retain their original moisture content, and this gives rise to a definite "carry-over" effect that influences the mortality and duration of the larval-pupal stage. The longevity of mated adults is only slightly affected by changes in humidity. At humidities of 0–3 and 21 per cent., however, they all die within a short period (1·5–2·0 days) while at the higher humidities a much greater range of survival (2·0–7·0 days) is evident. The rate of oviposition varies directly with the humidity, but this variation may be due to sampling methods. The seed coat of the cowpea has been shown to be an important factor in the humidity relations of this insect.

Horsfall (W. R.). **Biology of the Black Blister Beetle (Coleoptera : Meloidae).**—*Ann. ent. Soc. Amer.* **34** no. 1 pp. 114–126, 10 figs., 7 refs. Columbus, Ohio, 1941.

The results are given of a study made in Arkansas in 1938 and 1939 of the biology and the morphology of the immature stages of *Epicauta pennsylvanica*, DeG., which is typical of a number of species of Meloids the larvae of which feed on grasshopper eggs. The rearing technique is described. There is only one generation a year in the field, the winter being passed in the egg stage, or as a larva in the first or sixth instar. The adults, which feed on pollen, and apparently exclusively on that of goldenrod and a small wild aster, begin to emerge from the soil in late August and are present in north-western Arkansas until the middle of November. The females deposit their eggs in compact masses of about 100–200 in the soil at the bottom of a tubular cavity, and the triungulins, which hatch in about 15 days under favourable weather conditions, burrow to the surface one or more days later and wander until

they find the egg pods of grasshoppers. If conditions of temperature and moisture are favourable, they begin to feed within a short time, but if weather conditions become unfavourable, they may remain quiescent throughout the winter and begin to feed when the temperature rises sufficiently in spring. Only one larva at a time will develop in the same place in the egg mass of a grasshopper. After passing through five feeding instars, the larva burrows downwards into the soil, constructs a chamber and either pupates or enters a sixth instar. The sixth-instar (coarctate) larva does not feed, is immobile and highly resistant to desiccation, and can withstand extremes of temperature. After a variable period (six days to several months in the laboratory), it enters the seventh instar, in which it is active and superficially resembles the fifth-instar larva, but does not feed. It burrows towards the surface of the soil and constructs another chamber in which it pupates.

CARLSON (J. W.). *Lygus* **Bug Damage to Alfalfa in Relation to Seed Production.**—*J. agric. Res.* **61** no. 11 pp. 791–815, 12 figs., 12 refs. Washington, D.C., 1940.

The following is substantially the author's summary. An investigation was made of the effects of *Lygus hesperus*, Knight, and *L. elisus*, Van D., on lucerne in relation to seed setting, and of the extent to which these Capsids have contributed to a rapid decline in lucerne seed production in several formerly highly productive seed-growing regions of the western United States [*cf. R.A.E.*, A **27** 462; **29** 441].

Several types of bud damage are found in lucerne. A mechanical localised damage has been shown by controlled infestation to result directly from punctures and lacerations made by the mouth-parts of feeding *Lygus*, although pathological effects develop indirectly from the initial damage caused by the insects. Damaged buds show discoloration and evidence of deterioration in from 24 to 48 hours after injury. A rapid disintegration of the buds, apparently caused by a toxic substance emitted with the saliva of the insects, follows injury. Rosetting has been shown to occur under heavy *Lygus* infestations and is characterised by the development of racemes of buds near the tips of main stems and branches into disk-like clusters. Bud abortion, another type of damage occurring in lucerne, is apparently caused not by *Lygus* but by physiological factors. Individual lucerne flowers are shed soon after injury by *Lygus*. Damage to flowers results mainly from punctures in the ovary or other succulent parts, but all flower damage in lucerne is not attributable to insect attack and some may be due to factors affecting fertilisation and embryo development. *Lygus* injury also affects the vegetative growth and development of lucerne. Young growth when heavily infested is definitely retarded, and shows a tendency to excessive branching. A high proportion of the leaves of heavily infested plants may be crinkled or deformed.

Changes in the character of vegetative growth and reproductive development of lucerne plants follow removal of a *Lygus* infestation. Evidence of recovery from damage usually becomes noticeable within 10 days. Bleached and discoloured buds give early indications of *Lygus* damage to lucerne infested in the full-bloom stage. Rosetting develops as a later effect. Vegetative growth is not retarded by late infestation, but severe damage to the buds and flowers may result.

Uninfested plants that received frequent applications of an insecticide gave significantly higher yields of seed than did infested plants. Infested plants, however, gave a significantly higher yield of air-dry forage, but it is not known whether this resulted from the effects of *Lygus* injury or from a failure of the plants to set an abundance of seed. Numerous observations made during survey studies to determine the cause of lucerne seed-crop failures have shown serious damage to lucerne to result more or less directly in proportion to the *Lygus* population of the seed fields. The bugs are therefore regarded as an important cause of the major lucerne seed-crop failures in Utah [*cf.* **27** 462].

Service and Regulatory Announcements, January–March 1941.—*S.R.A., B.E.P.Q.* no. 146 pp. 1–42. Washington, D.C., U.S. Dep. Agric., 1941.

Administrative Instructions (B.E.P.Q. 503 second revision) relating to Quarantine no. 72 against the white-fringed beetles, *Pantomorus leucoloma*, Boh., and *P. peregrinus*, Buchanan, modify the conditions for the treatment of nursery stock in soil balls with a solution of methyl bromide and ethyl alcohol by a method already described [*R.A.E.*, A **28** 490, 610] against the larvae of both species [*cf.* **29** 610]. The treatment of plants in soil balls not exceeding 8 ins. in diameter is now permitted at a temperature not lower than 55°F. except in two parishes in Louisiana, where the consistency of the soil is such that it can be applied only to soil balls not exceeding 7 ins. in diameter and at a temperature not lower than 65°F. Administrative Instructions (B.E.P.Q. 486 revised) permit the fumigation of nursery stock under a partial vacuum in addition to fumigation at atmospheric pressure [**27** 591]. Nursery stock in soil balls not exceeding 11 ins. in diameter may be fumigated with methyl bromide at the rate of 4 lb. per 1,000 cu. ft. space for 1½ hours at a temperature of 75°F. or above and under a partial vacuum equivalent to at least 24·5 ins. mercury, which must be maintained throughout the exposure period. A standard vacuum fumigation chamber capable of withstanding an external pressure of at least one atmosphere and a vacuum pump of sufficient capacity to reduce the pressure within the vacuum chamber to the equivalent of 3 ins. mercury in not more than 20 minutes are required. The fumigant and air must be thoroughly mixed by being circulated in the chamber by means of a fan for the first 15 minutes of the exposure period, and the soil balls thoroughly cleansed with air after the treatment. Administrative Instructions (B.E.P.Q. 486 revised) authorise, in addition to methods already noticed [**27** 591], the treatment under supervision of potting soil in containers by fumigation with carbon bisulphide against all stages of *P. leucoloma* and *P. peregrinus*. The soil, which should be friable and must not be wet, should be in tight containers, not more than 36 ins. deep, provided with lids or tarpaulin covers, and preferably lined with sheet metal; the temperature of the soil should not fall below 40°F. during the treatment. The carbon bisulphide, which should be comparable to U.S.P. grade having a specific gravity of 1·25 at 68°F., must be used at the rate of 2 lb. per cu. yd., evenly distributed in holes 3 ins. deep and 1 ft. apart over the surface of the soil, and should be immediately covered with soil; the soil must be exposed for 48 hours.

WILSON (H. F.), DIETER (C. E.) & BURDICK (H. L.). **Insecticidal Dusts. A Study of the Effect on Mortality of electrostatic Charges produced by Friction in applying Insecticides.**—*Soap* **17** no. 4 pp. 99, 101, 121, 6 refs. New York, N.Y., 1941.

The following is the authors' summary. Frictional electrostatic charges are produced in the process of applying insecticidal dusts. A study of the effect of electrostatic charges on the effectiveness of insecficidal dusts is being made. When oil is added to dusts the electrostatic charge may be increased or decreased according to the diluent used. There was a definite indication that the degree of charge has a bearing on the effectiveness of the dust. Dusts producing comparatively high charges generally give higher mortality than dusts producing low charges. Pyrophyllite, flaky talcs, calcium carbonate and gypsum produce comparatively high charges and give high mortality. The clays and other talcs studied produce low charges and give low mortality.

GAHAN (A. B.). **A Revision of the parasitic Wasps of the Genus *Necremnus* Thomson (Eulophidae; Hymenoptera).**—*J. Wash. Acad. Sci.* **31** no. 4 pp. 196–303. Menasha, Wis., 1941.

This revision deals with eight species of *Necremnus*, four of which (all from the United States) are described as new. They include *N. oregonensis*, sp. n., reared from *Hypera rumicis*, L., in Oregon, *N. duplicatus*, sp. n., from *Ceuthorrhynchus assimilis*, Payk., in turnip seed-vessels in Washington State, and *N. leucarthros*, Nees, which was reared in the laboratory in Utah from material imported from Europe in connection with the introduction of parasites for the control of *H. variabilis*, Hbst., but is not known to have been released in the United States.

Summary of the Scientific Research Work of the Institute of Plant Protection for the Year 1939. [*In Russian.*]—Med. 8vo, 184 pp., 1 map, 8 graphs, 19 figs. Leningrad, Lenin Acad. agric. Sci., 1940. Price 8 *rub.* 50 *kop.*

This collection of summaries of reports by various authors on work in the Russian Union comprises the following sections: Pests and Diseases of Grain Crops (pp. 5–94); The Beet Weevil (pp. 95–104); Pests and Diseases of Fruit Cultures and Vines (pp. 105–120); The Biological Method of Control (pp. 121–129); The Chemical Method (pp. 130–152); and Mechanisation (pp. 153–181), which deals with equipment for spraying, dusting, treating grain, mixing poisoned baits and fumigating the soil. The following summaries deal with pests or insecticides.

PREDTECHENSKIĬ (S. A.). **A Study on the Conditions of the Outbreaks of the Locusts and Grasshoppers in Areas suitable for permanent Development and the Improvement of Control Measures against them,** pp. 5–10. In the autumn of 1938, eggs of *Locusta migratoria*, L., occupied an area of nearly 260,000 acres in the flood plains of Amu-Dar'ya, and a further increase was expected in 1939. In the outbreak areas round the northern shores of the Caspian Sea, dense locust deposits were not extensive, and a reduction of infestation was expected. In the Kazalinsk region of the Province of Kzuil-Orda, the locusts were

still numerous. Dense egg-deposits in the autumn of 1937 in the Kuban flood plains were submerged, and no gregarious locusts appeared there in 1938 [*cf. R.A.E.*, A **27** 553]. Only solitary locusts occurred in the Balkhash, Ili, Ala-Kul', Sasuik-Kul' and Zaĭsan outbreak areas. Meteorological conditions in Central Russia were favourable for the development and fertility of the northern race, *L. m. rossica*, Uv. & Zol., and a transformation into the gregarious phase was expected by 1939. A warning to that effect was issued to local authorities and was justified by the appearance in Tambov Province of small swarms of gregarious locusts.

P. A. Vel'tishchev studied seasonal fluctuations of *L. migratoria* in the Ala-Kul' and Balkhash outbreak areas, where only the solitary phase had been observed for 3–5 years. Observations have shown that not more than 2–3 per cent. of the individuals hatching in spring survive until oviposition occurs. Studies of the stomach contents of vertebrates in locust habitats showed that many of them had fed on locusts. Wide fluctuations in the numbers of adult locusts within a given area are often due to migrations, which suggests that the evaluation of results of control measures should be made immediately on the conclusion of the campaign. Regardless of their great mobility, locusts tend to concentrate in certain habitats; in the Amu-Dar'ya area, these are characterised by a vegetation of sparse reeds [*Phragmites communis*] and reeds mixed with *Calamagrostis pseudophragmites*. In the Amu-Dar'ya, flights of *L. migratoria* occur in the evening and during the night when the temperature above ground level is not below 20°C. [68°F.], and the daytime when evening temperatures are lower. The development of the eggs requires that a sum of effective temperatures, *viz.*, those above 10°C. [50°F.], at a depth of 2 ins. in the soil, where the egg-pods lie, should reach 320–330°C. [576–594°F.]. The approach of hatching can be detected by boiling locusts eggs in water; this causes them to redden, and a scale can be produced permitting field workers to determine the stage of embryonic development from the degree of reddening. A female is able to oviposit at least four times, the number of eggs falling from 80-90 at the first oviposition to 40–60 in the last. By dissection of the females, it is possible to determine whether they have already oviposited, for in such a case an orange coloured remnant of follicular epithelium can be found at the base of the empty egg-tubes. In this way, the beginning of egg-laying can be established in the field when direct observation of oviposition may be difficult owing to scarcity of locusts.

Filatov and Kayudin studied fluctuations in the populations of grasshoppers in two areas. In the Chelyabinsk area, the northern species, including *Aeropus sibiricus*, L., and *Stauroderus scalaris*, F. W., were greatly reduced in numbers in 1937 and 1938 by the fungus, *Empusa grylli*, which was favoured by rainy weather. In 1939, however, the first half of the summer was dry and the numbers of ovipositing grasshoppers were normal, and it was possible to forecast their increase in 1940. In the more southerly Aktyubinsk area, the numbers of *Calliptamus italicus*, L., *Dociostaurus crucigerus*, subsp. *brevicollis*, Eversm., and *Chorthippus albomarginatus*, DeG., decreased during the period 1934–39. Studies on the density of the grasshopper population by counts were found to be unreliable, owing to small-scale migrations, which occur throughout the day. Of grasshoppers marked with paint in the morning in one area, only 10 per cent. were still there in the evening, but the population was increased by

immigrants to 35·7 per cent. of the original number. The intensity of migrations depends mainly on insolation and the physiological state of individual grasshoppers.

E. M. Shumakov studied the physiological and histological causes of phase variation in locusts, particularly the distribution of the green and the black pigments. Studies of gaseous metabolism in *Locusta migratoria* showed that the oxygen consumption per unit of live weight was the same in both phases [*cf.* **24** 229].

Stark (V. N.). **A Study upon the Agrobiology of Soil Root Pests (Elateridae, Melolonthinae, Tenebrionidae) in order to base destructive and prophylactic Control Measures against them,** pp. 10–23. Investigations by V. M. Berezina in the Province of Ordzhonikidze (northern Caucasus) showed that adult Tenebrionids were attracted to trap heaps and baits in the greatest numbers during the period of the feeding and pairing, less so during oviposition and not at all after it had ceased. Baits should therefore be applied against *Opatrum sabulosum*, L., from the end of April till mid-July, and against *Pedinus femoralis*, L., from the end of April till the end of May and again from the end of July till the beginning of September. The best results were obtained from heaps of mulch or dry grass, the latter being preferred by *O. sabulosum* in all kinds of weather, whereas *P. femoralis* concentrated under dry grass on dry and hot days and under mulch in rainy or cold weather. Breaking the soil to a depth of about 2 ins. under the heaps increased their effectiveness. Of the food baits, cottonseed cake was more effective than wheat grains. The Tenebrionids were most abundant in black fallow, and in autumn concentrated under weeds that had been uprooted by ploughing. Wheat sown in fallow land was lightly infested, and larvae of *P. femoralis* were scarce in fields of wheat sown after cotton, which may have been due to poisoning by feeding on cotton seeds [*cf.* **21** 54].

Laboratory experiments by Stark showed that overwintered adults of the Tenebrionids, *Blaps halophila*, Fisch., and *B. lethifera*, Marsh., collected in the field and kept at 23–25°C. [71·6–77°F.], were most active and fed intensively at atmospheric humidities of 80–100 per cent., whereas at 50 per cent. most of them ceased feeding and congregated under various shelters or burrowed into the soil. This reaction to humidity was most pronounced in spring. When the relative humidity was above 80 per cent. the beetles preferred dry, loose and warm soil, but when it was lower they congregated on damp, cold and compact soil and under thick shelter. Maximum reaction to any stimulus was shown at 20–35°C. [68–95°F.]. Below 11°C. [51·8°F.] there was scarcely any reaction to food or moisture, while above 35°C. the beetles ceased feeding, avoided light and readily reacted to humidity. This last reaction ceased at 40°C. [104°F.], death set in at 47°C. [118·6°F.] and all the beetles died at 57°C. [134·6°F.]. Sharp fluctuations in temperature decreased the reactions of all the Tenebrionids tested, but when the temperature was allowed to rise from 5 to 38°C. [41 to 100·4°F.] in the course of 24 hours, the reaction to food and the intensity of feeding increased. The beetles fed once in 24 hours in spring, but only once in 2-3 days at the end of June.

Field experiments were carried out by S. S. Deev in the Province of Voronezh on the control of adults of *Melolontha hippocastani*, F., during the period of supplementary feeding. A dust of sodium fluosilicate was applied when the beetles concentrated on birch and

oak, which they did 8–11 and 13–20 days, respectively, after the beginning of the flight. Practically all of them were killed when the dust was applied at the rate of 40–55 lb. per acre. Mortality was highest on the first day and continued at a gradually decreasing rate for six days. Dusting should be carried out after the mass appearance of the beetles from the soil and before the beginning of mass oviposition, which occur, respectively, 8 and 20 days after the beginning of flight. The beetles started to emerge from the soil when the temperature at a depth of 4 ins. reached 11°C. [51·8°F.], and mass flight occurred when the temperature at that depth reached 13·5°C. [56·3°F.].

In laboratory investigations by S. G. Bobinskaya on the behaviour of adults of the Elaterids, *Agriotes obscurus*, L., and *Corymbites* (*Selatosomus*) *aeneus*, L., 20–21°C. [68–69·8°F.] was the optimum temperature for egg maturation and feeding, and the latter was most intense at the beginning of adult life. In the district of Cherepovetz, Province of Vologda, adults of *A. obscurus* predominated in clover fields of the first and second year, on oats sown after clover and on potatoes. During the day, they sheltered under plant débris.

The possibility of attracting Scoliid parasites of Melolonthid larvae to foci of infestation by cultivating in such places plants from which the adults take nectar was studied by Deev in the Province of Voronezh. Of the five wild plants that were visited in a coniferous forest, two (*Eryngium planum* and *Thymus serpyllum*) were successfully propagated by planting out the rhizomes, which was best done in mid-October or early spring. The adults of *Scolia quadripunctata*, F., *S. hirta*, Schr., and *S. flavifrons*, F., were readily attracted to the flowers of *Phacelia*, and those of *S. dejeani*, Linden, were attracted to them in an insectary. In order to obtain continuous flowering during the flight period of *S. dejeani*, *Phacelia* should be sown on 5th, 15th and 25th May.

G. E. Mach gives lists showing the Lamellicorn larvae that were and were not parasitised by various Scoliids in the Province of Voronezh, and considers that the Scoliids that show the greatest promise in the control of such larvae are : *S. dejeani* and *Campsomeris klugi*, Linden, against *Polyphylla fullo*, L. ; *S. quadripunctata* against *Epicometis hirta*, Poda ; *C. sexmaculata*, F., against *Anoxia pilosa*, F. ; and *Tiphia femorata*, F., against *Amphimallus* (*Amphimallon*) *solstitialis*, L., *Melolontha hippocastani* and *Anisoplia austriaca*, Hbst. Third-instar larvae of *Liocola lugubris*, Hbst., and to a less extent those of *Cetonia aurata*, L., were found to be suitable alternative hosts for the mass breeding of *S. dejeani* and *S. quadripunctata* ; promising results were also obtained with larvae of *Potosia aeruginosa*, Dru. (*speciosissima*, Scop.). The host larvae should be reared at 25–27°C. [77–80·6°F.], and the adults of *Scolia* spp. should be kept at an even temperature of 25–28°C. [77–82·4°F.] in roomy insectaries with a layer of oven-dried sand that has been slightly wetted with sterile water.

Observations by B. M. Safronovich showed that the fecundity of females of *S. quadripunctata*, *S. hirta*, *S. dejeani*, *C. sexmaculata* and *T. femorata* taken in nature varied greatly in each species. Dissected examples contained 14–57 eggs, of which 1–46 were deposited. The females of all these species emerge with a developed fat-body, which becomes gradually exhausted with the maturation of eggs. All except *S. quadripunctata*, which apparently requires supplementary feeding, begin oviposition immediately after emergence. Fertility was very low in *C. sexmaculata*, but somewhat higher in *C. klugi*.

With a view to breeding several annual generations of Scoliids in the laboratory, as compared with one in the field, preliminary experiments were carried out by Mach with cocoons of *S. flavifrons* to determine whether exposure to low temperatures would make the diapausing larvae develop more quickly. Cocoons that had been received three months previously were subjected for periods of up to 30 days to temperatures of 0–10°C. [32–50°F.] or from −4 to −11°C. [24·8–12·2°F.], and were then transferred to 27°C. [80·6°F.], but development was no quicker than in the controls. Emergence continued for 50 days with periods of maximum intensity 32–41 and 51–66 days after the cocoons were transferred to the higher temperature.

Examinations by T. G. Grigor'eva of soil from fields under various crops in the Province of Vologda showed that eggs and young larvae of *Agriotes obscurus* and *A. lineatus*, L., which were the most important Elaterids present, occurred in all fields, but were most numerous in those under clover, flax or spring wheat. In this district wheat is followed by grass, which makes conditions favourable for the survival of the larvae. The greatest numbers of overwintered larvae, including many large ones, occurred under flax or potato following flax; such potato fields also harboured numerous pupae, which had evidently resulted from larvae that had hatched in fields under spring wheat. When clover fields were broken up, a considerable number of the larvae remained in the sod turned over by the plough, and as they found sufficient food there, migration to the living roots of young plants was delayed. As a result, only 16 per cent. of oats sown in a former clover field with a wireworm population of 150 per sq. yd. were damaged at the time of sprouting and the yield was comparatively high. This fact would, probably, also account for the belief that flax is not injured by wireworms, since it is usually sown after clover.

Field experiments by A. N. Kasikhin in the Province of Vologda showed that satisfactory crops can be raised in fields infested by wireworms by increasing the amount of seed sown by 25–40 per cent. Cultivating fallow markedly reduces the number of wireworms, particularly if carried out on warm summer days when they concentrate close to the surface of the soil.

In the course of preliminary laboratory studies by N. M. Édel'man on the resistance to cold of insects that hibernate in the soil, it was observed that adults of the Tenebrionid, *Pedinus femoralis*, were more resistant in autumn and winter than in summer. Adults of *Opatrum sabulosum* were more resistant than those of either *P. femoralis* or *Blaps halophila*, and those of all three species were less resistant after being kept in damp than in dry sand. Larvae of *B. halophila* were more resistant than those of *B. lethifera*. On the whole, however, the larvae were less resistant than the adults.

Zambin (I. M.) & Karpova (A. I.). **A bioecological Basis of chemical Control Measures against the Frit Fly** (*Oscinella frit*), pp. 23–26. The attractiveness to adults of *Oscinella frit*, L., of the essential oils from 13 plants was studied in a McIndoo olfactometer [**14** 456]. The results, which are tabulated, showed that coriander oil at a concentration of 1 : 10,000 was the most attractive. When similar tests were carried out with the undiluted juices pressed from various parts of cereals, the most attractive were those from stems of millet [*Panicum miliaceum*] 8 ins. high with 3–4 leaves, and from oat sprouts about ½ in. high. Formalin repelled the adults at a concentration of 1 : 1 and was not

very attractive at lower concentrations. A comparison of data on the phenology of cereal crops in the Province of Leningrad and the seasonal history of the fly indicated that the best time to apply chemicals against it would be the second half of June and the second half of August, to protect spring and early sown winter crops when they are sprouting. Since the flies like warmth and light and avoid wind, treatments should be carried out in quiet sunny warm weather between 9 a.m. and 1 p.m. at a temperature of 20–29°C. [68–84·2°F.] and a relative humidity of 70–90 per cent. In fields of spring cereals, infestation is greatest along the edges adjoining fields that have been severely infested in the preceding year, and treatment can be restricted to such parts.

ARKHANGEL'SKIĬ (N. N.). **A Study upon the injurious Corn Bug *Eurygaster integriceps* Put. in Order to elaborate Control Measures against it,** pp. 26–35. Serious damage to cereals in the northern Caucasus is caused by the Pentatomids, *Eurygaster integriceps*, Puton, which constitutes 80–90 per cent. of the population, *E. maura*, L., *E. austriaca*, Schr., and *Aelia* spp. These Pentatomids hibernate in the adult stage, chiefly under fallen leaves in forests, dense growths of shrubs and protective strips of trees. In the Province of Rostov, they begin to migrate to the fields in the second half of April, when the temperature in the litter exceeds 21°C. [69·8°F.], and the flight extends over several weeks. On dull days, the bugs shelter under leaves and lumps of soil ; they begin to feed when the air temperature reaches 20°C. [68°F.] and the humidity 60 per cent., and fly and pair at 24°C. [75·2°F.]. They are most active at 25–32°C. [77–89·6°F.] and become torpid below 7°C. [44·6°F.]. The potential fecundity of the females of *E. integriceps* is over 250 eggs, but the number deposited depends on the development of the fat-body, nutrition and weather. In 1939 the first batches of eggs were found about 10th May. Usually, development is completed in the field in which hatching takes place, but under conditions of overcrowding or lack of food, and during harvest, the older nymphs and young adults migrate to adjoining crops.

It has been found that the presence of about three bugs and 12 egg batches (giving rise to about 150 nymphs) per 10 sq. ft. will lead to a loss of often 60 and sometimes 100 per cent. of the crop, but if conditions are unfavourable for the growth of the plants, an average of two bugs per 10 sq. ft. will destroy the crop. Wheat and barley suffer most, rye often escapes severe injury, as it develops more rapidly, and oats are least attacked. As result of the feeding of the bugs, side shoots do not develop, parts of the stems die off, the ears turn white, and the germinating power and baking properties of the grain are impaired [*cf.* **27** 554, etc.].

Migration to hibernation quarters does not occur until the bugs have developed a fat-body and is then to a certain extent induced by temperature and humidity. The lower critical temperature varies widely, depending on the amount of fat-body and other factors ; at the beginning and the end of winter it is about −8 and −4°C. [17·6 and 24·8°F.], respectively. The bugs are protected from freezing in their winter quarters by litter and snow. When the temperature of the air was −10·6° [12·92°F.], that in litter under 4 ins. of snow was only −2·3°C. [27·86°F.] in an old forest and −4·3°C. [24·26°F.] in a young one. In the middle of March, however, up to 90 per cent. of the bugs were killed in places where the snow had thawed and the temperature in the litter dropped to −13°C. [8·6°F.]. The eggs survived protracted storage

at—2°C. [28·4°F.], but soon died at —10°C. [14°F.]. The nymphs survived for up to 4 days at —2·5°C. [13·1°F.].

The control measures recommended include the destruction of the litter in hibernation quarters, the collection of the bugs by various mechanical devices, and ploughing the stubble under to a depth of 8 ins. followed by harrowing. Promising results were given by a spray containing a 5 per cent. solution of barium chloride, while preliminary experiments showed the value of liberating egg parasites in the field at the correct time and in sufficient numbers. In the environs of Pyatigorsk, the Scelionids, *Microphanurus semistriatus*, Nees, and *Telenomus sokolowi*, Mayr, were found hibernating in numbers under the loose bark of fruit trees. In 1931, however, parasites destroyed only a small percentage of the eggs of the bugs laid in the spring, as they did not appear in the field until the end of May.

Vasil'ev (I. V.). **The Results of Investigations upon the Pea Weevil in 1939,** pp. 35–40. Field observations by E. P. Gaenko in the environs of Kursk (central Russia), showed that the adults of *Bruchus pisorum*, L., appear on the pea plants as soon as they have begun to flower and the temperature reached 20°C. [68°F.]. They feed on the pollen before becoming sexually mature, and are active at 18°C. [64·4°F.] ; in dull weather they do not feed or pair, even at higher temperatures, and oviposition ceases if there is wind. Development of the immature stages is completed in about 65 days. Since the development of larvae in fallen pods is accelerated by soil temperatures as high as 58°C. [136·4°F.], all such pods should be ploughed under to a depth of at least 4 ins. immediately after harvest. In 1939, about 30 per cent. of the Bruchids were destroyed by the mite, *Pediculoides ventricosus*, Newp., and a few of the eggs were parasitised by *Bruchoctonus senex*, Grese. In laboratory experiments, adults removed from peas died in five and six days at —17·35 and —11·1°C. [0·77 and 12·02°F.], respectively, but 50 per cent. of those in the peas survived for 11–12 days at —21°C. [—5·8°F.]. Adults placed in cracks in a fence or under loose bark on trees survived the winter in a few cases, though the temperature fell to —27·9°C. [—18·22°F.] in January. In further experiments, the Bruchids were placed under different types of shelter on the surface of the soil, the temperature of which dropped to —20·4°C. [—4·72°F.] in the absence of snow in December and to —31·5°C. [—24·7°F.] in January when the snow was over 6 ins. thick. The approximate percentages that survived were 34 under a cover of grass and leaves, 17 under leaves alone and 14 under grass alone, as compared with 46 at a depth of 2 ins. in the soil.

Observations by R. E. Vasser on the emergence of the Bruchid from fallen pods after harvest showed that 98 per cent. emerged in a week at 26–28°C. [78·8–82·4°F.] and 100 per cent. relative humidity. Lower humidities and lower temperatures both retarded emergence.

In laboratory investigations by Vasser and Gaenko, overwintered females of *B. pisorum* fed on the pollen of 11 plants, but their ovaries did not develop. The ovaries became fully mature, however, 5–6 days after the Bruchids were transferred to flowering peas, and oviposition started after 8–9 days at 23–26°C. [73·4–78·8°F.] in the laboratory and after 9–10 days in the field. The optimum temperature for the development of the Bruchid was 27–28°C. [80·6–82·4°F.] ; development ceased at 10°C. [50°F.] in the field and 12°C. [53·6°F.] in the laboratory and was retarded at 35°C. [95°F.]. Based on the two figures for the

threshold of development, temperature sums are calculated for the complete development of the Bruchid and for that of the eggs, larvae and pupae, and a map is given showing the regions of European Russia that are and are not suitable for it.

Brudnaya (A. A.). **The Results of Elaboration and Improvement of Control Methods for the Protection of Grain in Store against Granary Pests in Kolkhoz (Collective Farm) Conditions,** pp. 41–45. Examination of 572 samples of seeds of cereals and other crops and of dust and débris from granaries in different parts of the Russian Union showed the presence of 20 species of injurious insects and 22 species of mites; some of the latter were rare, and others undescribed. The commonest species were the flour, hairy and elongate mites [*Tyroglyphus farinae*, DeG., *Lepidoglyphus destructor mixtus*, Zkhv., and *Tyrophagus noxius*, Zkhv.]. The first two were most common in moist wheat and rye and in dry oats and barley. Injurious insects occurred chiefly in sweepings, *Calandra granaria*, L., and *Ptinus fur*, L., being the most widely distributed.

The germinating power of grain infested with mites for about 50 days decreased by 31–36 per cent., and bread baked from infested flour had a bitter taste. Wheat infested by *C. granaria* at the rate of 10 weevils per kg. [2·2 lb.] lost 30·6 per cent. in weight in 161 days. Measures tested against the mites and the weevil included the use as a spray in empty granaries of a 3–5 per cent. dilution of a mineral-oil concentrate to which was added 10 per cent. of a technical mixture of oxydiphenyl. This preparation was also of value for spraying agricultural machinery. It was shown that in granaries the application of sprays at the rate of about 7·4 fl. oz. per sq. yd. is sufficient, although twice or four times this amount is commonly used. In experiments, examples of *Tyroglyphus farinae* and *Tyrophagus noxius* removed from the grain were killed by exposure for 30 minutes to 42 and 44°C. [107·6 and 111·2°F.], respectively. Previous exposure for 24 hours to −5°C. [23°F.] reduced the lethal temperatures by 2°C. [3·8°F.].

Ostapetz (A. P.). **The Results of the Studying of Grain Crop Diseases and Pests in the Voronezh Region based on Grassfield Crop Rotation,** pp. 45–49. Observations by A. V. Guseva in the Province of Voronezh showed that large numbers of *Macrosiphum onobrychis*, Boy., occur on lucerne, even in years when the Aphid is scarce on peas; consequently, fields of peas may become severely infested if they adjoin lucerne. Spring-sown wheat, used as a cover crop in sowings of grass, is heavily infested by *Mayetiola destructor*, Say, and oats or barley, which are less attacked, should therefore be substituted for it in districts in which the fly is common. Sowings of *Agropyrum* serve as a source of infestation of adjoining cereals by flea-beetles. In tests by P. M. Petrov of sprays against *M. destructor*, preparations of anabasine gave the best results and were effective against the eggs. Baits poisoned with sodium fluosilicate killed 92·5 per cent. of the larvae of *Agrotis* (*Euxoa*) *segetum*, Schiff., and dusting with this substance was also effective. Work by N. I. Ostrovskiĭ showed that autumn sowings and dense growths of coriander [*Coriandrum sativum*] are less attacked by the Eurytomid, *Systole coriandri*, Nikol'skaya [*cf.* **25** 400].

Kalashnikov (K. Ya.). **A Study upon Pests and Diseases of agricultural Plants in the extreme North,** pp. 49–52. Observations

by E. Yaĭtzevskaya on the bionomics of the Silphid, *Silpha* (*Aclypea*) *opaca*, L., in a mountain district in the Kola Peninsula showed that 50–60 per cent. saturation deficiency of the soil is essential for the hatching of the larvae. The adults that fed on chickweed (*Stellaria media*) laid almost twice as many eggs as those that fed on the leaves of beet, and those that fed on *Epilobium angustifolium* laid 16 times as many. Baits of weeds treated with sodium fluosilicate at the rate of 1 part to 50 by weight and placed in infested [? beet] fields attracted large numbers of adults and larvae and killed 30 per cent. of them. Of larvae taken to the laboratory after feeding on the baits, up to 90 per cent. died, but mortality among the adults was negligible. Dusting the plants with sodium fluosilicate killed about 12 per cent. of the adults and repelled the others.

Investigations by V. L. Nikol'skiĭ in the region of upper Eniseĭ in Siberia showed that severe damage to crops, especially those sown within a year or two of the breaking of the fallow, and to hay-fields, was caused by *Melolontha hippocastani*, F. As many as 5 larvae per sq. ft. were observed, and in July–August they concentrated at a depth of 4–8 ins. under the turf. Manuring and harrowing the hay-fields did not reduce the infestation, but increased the yield of hay and the resistance of the grass to injury. The adults feed on the foliage of trees and shrubs in the fields or at the edges of forests. Another important pest in this district is the Elaterid, *Agriotes obscurus*, L.

Pyatnitzkiĭ (G. K.). **Ecological Basis of the Control Measures against the Beet Weevil on old Beet Fields,** pp. 95–104. Field experiments were carried out in the Province of Kirovograd to work out a system of trap ditches against *Cleonus punctiventris*, Germ., that would secure an almost complete catch of the weevils at their hibernation sites and during their migration to new beet fields. It is known that up to 20 per cent. of the weevils hibernate for two winters without emerging and about 10 per cent. for three [*cf.* **28** 599]. The depth at which the hibernating weevils occur is greater during the second winter of hibernation than during the first, and greater still during the third. Because of this and because of the variations in the state of the soil in fields that have not been under beet for several years, the weevils appear on the surface at different times. Weevils in fields that have not been under beet in the preceding year, and are usually under pulses, appear 5 days later than those in the previous year's beet fields, and those in the next year's fields, which are usually occupied by autumn-sown crops, do so 7–10 days later. Daily counts in trap ditches of the weevils that emerged in small sample plots and of those that appeared in new beet plantations showed that the numbers of the latter were markedly increased by immigrants that flew from adjoining fields after practically all the weevils had emerged and migration by crawling was over. This indicated that the collection of weevils from trap ditches can generally be stopped 3–5 days after the beginning of the mass flight. It is considered that if the system of trap ditches is adequate, only about 10–15 per cent. of the weevils that emerge in old beet plantations escape them and subsequently fly to new plantations.

Observations on the movements of the weevils on the soil showed that as a rule they move so that the rays of the sun strike them from the side and so warm their bodies evenly. For most of the day, therefore, they move in a northerly or southerly direction. They also

prefer to move against the wind and down a slope. The distance covered is not more than 220–330 yards in a day, with an average of about 175 yards for the total period of migration by crawling. Since about half the weevils move in a direction opposite to that of the other half, the number that will be trapped in ditches round the edges of a large field will be about half the total number that emerge from hibernation in a strip about 220 yards wide round the edges and the proportion of the total population trapped will be in inverse ratio to the size of the field. Fields that are less than 220 yards across need have no ditches inside them, but if all weevils are to be caught in large fields, the latter should be divided by ditches 220 yards apart.

In experiments on the effectiveness of shallow trap ditches [*cf.* **24** 488], in which stained weevils were released in a field covered with a network of them, it was calculated that one ditch trapped about 3·5 per cent. of the total number of weevils present. From this and the fact that the distance covered by the weevils during the period of their migration by crawling averages about 220 yards, it is calculated that there should be at least 30–33 rows of ditches about 7 yards apart over this distance, or a network of ditches measuring about 15 × 15 yards. The total catch does not increase in direct proportion to the frequency of the ditches, since fewer weevils are trapped in each successive one. In order to secure an almost complete catch, the network of ditches should measure not less than 11 × 11 yards, and this conclusion was supported in subsidiary experiments. Since the weevils tend to move towards the north and south and down a slope, ditches running east and west or across a slope should be somewhat closer together than those at right angles to them. In experiments, the numbers of weevils trapped in ditches crossing their line of movement were 15–20 per cent. greater than those in ditches parallel with this line.

Printz (Ya. I.). **Elaboration and Selection Results of *Phylloxera* resistant Varieties of Grapes and the Working out of ecological Indexes on *Phylloxera* for the Basing of *Phylloxera* Virulence and chemical Control Method,** pp. 105–112. In Azerbaijan and Georgia *Phylloxera* [*vitifoliae*, Fitch] occurs to a depth of 6½–10 ft. on the roots of grape vines, but nymphs (forms with wing-pads) develop chiefly in the upper 4–10 ins. of the soil and rarely at a depth of 16–26 ins. Laboratory and field observations showed that transformation to nymphs does not take place at temperatures below 24–25°C. [75·2–77°F.]; in Transcaucasia, Daghestan and the Ukraine, the soil reaches this temperature down to a depth of 26 ins., though below 16 ins. the period during which it does so is short. Mass formation of nymphs takes place at 27–30°C. [80·6–86°F.]. In Transcaucasia, the vapour of paradichlorobenzene does not penetrate deeper than 26–28 ins., but this would suffice to destroy the nymphs in all the vine-growing districts in the Russian Union.

It was also found that the composition of the saliva of *Phylloxera* changes with the variety of vine on which it feeds. Prolonged feeding on the roots of Caucasian vines decreased the vigour, as measured by the intensity of infestation and fertility, of all races of *Phylloxera*. After feeding for 30–40 years on Caucasian vines, *Phylloxera* loses the ability to form galls on American varieties and produces very few nodosities on their roots. The ability to form galls is restored only after several decades of breeding on the roots of American vines. The appearance of galls on American seedlings in new plots within the

first few years of planting indicates that the strain of *Phylloxera* originated from American vines, and not from European or Asiatic ones [*cf.* **25** 661]. It was also found that the abundance of *Phylloxera* on the roots of American seedlings or stocks is due to intense propagation of the Aphids on the roots and not to their migration from the leaves.

A histological study by K. I. Larchenko showed that the larvae of the root form do not produce typical fat tissue unless their food is of a definite composition, and that production of such fat tissue leads to transformation into nymphs. Lack of albumen reduces the maturation of eggs. The eggs laid by the alatae are matured during the nymphal stage ; they develop only at a temperature of, or above, 23°C. [73·4°F.], and in the presence of contact humidity. Unfavourable weather at the time of oviposition by alatae kills the eggs, so that the sexuales, winter egg and fundatrix are absent from the cycle of development, and no galls will occur in spring. Feeding on different American and European vines results in the appearance of nymphs in varying numbers, at different times and over varying periods. A mass appearance of the nymphs may to a great extent free the roots from *Phylloxera*, and should the eggs of the alatae be killed by unfavourable weather, the increase of the Aphid on the roots may be very slow.

Investigations by Ya. S. Kruim showed a positive correlation between the resistance of vines to *Phylloxera* and the content of phenols in them. The roots of resistant American varieties and hybrids were richer in phenols than those of the non-resistant European and Asiatic varieties, but the reverse was observed in the case of the leaves. *Phylloxera* forms galls easily on most of the American vines, but very few or none on European varieties. In view of the fact that galls are not produced on old leaves, V. A. Yablokova analysed the cell juices of young leaves and showed that in them anthocyanins, which are apparently phenol compounds, predominated over tannin. When galls were formed on the leaves of American varieties, or nodosities on young rootlets of different varieties, tannin and albuminous substances increased at the site of puncture, and starch was deposited, which served as food for the Aphids.

The relation between soil and the amount of phenols present in a vine was studied by M. G. Chernuisheva on one local variety planted in 12 different soils. Repeated analyses of the humus and the products of its decomposition (nitrates, free phosphorous acid and bases), as well as of the phenols in the leaves of the vine, showed that the reserve of nutritive substances in the soil varied within limits peculiar to each soil type. The amount of phenols in the leaves varied with the soil and with the time of year. It was greatest in vines on acid red soils, and reached a peak in May, when the soil contained a maximum of bases and hydrolytic acidity was low. This accumulation of phenols in the leaves did not coincide with the greatest abundance in the soil of nitrates and free phosphorous acid, which occurred in July when the shoots become lignified and the grapes begin to ripen. Nitrogen should not be introduced into the soil at this time, but the addition of potash is of value. Adequate watering will also increase the resistance of vines to *Phylloxera*.

In field experiments in Azerbaijan, H. P. Shabanova obtained complete mortality of *Phylloxera* on the roots of vines to a depth of 24–40 ins. by applying a mixture of carbon bisulphide and paradichlobenzene [*cf.* **24** 220] at the rate of 4·2 oz. per sq. yd. in holes 6–7 ins. deep and

14 ins. apart and introducing paradichlorobenzene at the same time into the upper layer of soil round the root collar to destroy the Aphids on the dew-collecting roots. To destroy any that occur on roots deeper than 40 ins., supplementary fumigation by means of an injector is necessary. In a study in Azerbaijan by I. L. Gippius on the diffusion of carbon bisulphide in heavy clay soil with a humidity of 17–25 per cent., the gas penetrated to a depth of 52 ins. when introduced at the rate of 15 oz. per sq. yd. in holes 6 ins. deep and 14 ins. apart, but only traces occurred at depths of 56 or 60 ins. When applied at the rate of 3 oz. per sq. yd. in holes 6 or 12 ins. deep and 14 ins. apart, it penetrated to depths of 28 and 32–36 ins., respectively. The amount of carbon bisulphide present was low in the upper 4 ins. of soil and reached a maximum at 8–16 ins.

Parfent'ev (V. Ya.). **Results of Investigations on the Basing and Testing of experimental Modifications of the Control Method System in the Gardens of the Krasnodarsky Region,** pp. 112–120. Of seven spray schedules against pests and diseases of pome fruits tested in the region of Kuban (northern Caucasus), on both young and old apple trees, the most effective comprised two applications before flowering of 1 per cent. Bordeaux mixture as a fungicide, and five applications after flowering of 0·3 per cent. calcium arsenate (with 1 per cent. Bordeaux mixture in the first four) against the codling moth [*Cydia pomonella*, L.], other Lepidoptera and fruit weevils. This treatment doubled or trebled the yield of fruit, as compared with orchards in which the measures usual in the district had been applied, and increased it fifteen-fold in individual cases. A complete schedule is given for the treatment of pome-fruit trees in the region of Kuban, showing when the various measures should be applied and the pests or diseases against which they are directed.

In investigations by L. N. Zotzenko on methods of timing sprays against *C. pomonella* on apple, the best results were given by observing the development of the first and second generations in insectaries under natural conditions. A time-table of treatments was drawn up, and it is recommended that the first application against the first generation should be made while the calyx is open, the second at least 10 days later but before the larvae begin to hatch, and the third not later than 15–17 days after the second. Applications against the second generation should begin before the larvae hatch or when 25 per cent. of the first-generation adults have emerged from control trap bands, and should be repeated at intervals of 10–15 days, depending on the intensity of adult flight, weather conditions and the variety of apple concerned. Bait traps for the adults are of no value in the Kuban region owing to the high atmospheric humidity.

Observations by F. S. Ibatulina showed that the optimum temperature for the development of *Rhynchites bacchus*, L., is between 20 and 24°C. [68–75·2°F.], fertility is greatest at 21–22°C. [69·8–71·6°F.], and the optimum for the overwintered weevils is 21–25°C. [77°F.]. In the district of Slavyansk (Province of Krasnodar), the temperature during May-September averages 20°C., and is, therefore, favourable to the weevil. If development occurred under unfavourable conditions of temperature and humidity, the resulting adults did not survive the winter. A certain amount of contact humidity is essential for the larvae ; if the infested fruits dry up rapidly, their development is protracted and they sometimes die. The period of larval feeding usually

lasts 35–45 days. The larvae begin to leave the fruits in June, which is the wettest month of the summer, but cease to do so during dry periods. Oviposition takes place at a relative humidity of 65–80 per cent. At higher or lower humidities, the weevils feed reluctantly and die without ovipositing. Fertility was greatest in individuals that fed first on stone-fruits and then on pome fruits and least in those that fed on stone-fruits alone. Feeding on pome fruits alone retarded oviposition by five days. Fertility was also affected by the amount of albumen in the food; considerably fewer eggs were laid in 1939 than in 1938, as fruit buds were scarce and the weevils fed chiefly on leaf buds and young shoots, which contain less albumen. The adults disseminate *Monilia cinerea*, the fungus that causes brown rot [*cf.* **25** 505], only when it fructifies, and the intestinal tract and surface of the weevils then become a source of infection to healthy fruits.

Meĭer (N. F.). **Results of the Work of the Laboratory of biological Control at the Institute for Plant Protection,** pp. 121–124. From the examination of material from various parts of the Russian Union, the author considers that in addition to various races of *Trichogramma evanescens*, Westw. [*cf.* **27** 589], three distinct species of *Trichogramma* occur. He intends to describe these as *T. pallida*, *T. turkestanica* and *T. pini*.

Experiments by Afanas'eva showed that the duration of development of *Trichogramma* in the field depends not so much on the mean day-and-night temperature as on the proximity of the absolute thermal minimum to the lower threshold of development of the parasite, and on the frequency with which such proximity occurs. Thus, at the almost equal mean day-and-night temperatures of 17·6 and 18·4°C. [63·68 and 65·12°F.], and an identical temperature minimum of 0·5°C. [32·9°F.], the life-cycle was completed in 27·6 days in one case and in 22·4 in the other; the difference must have been due to the frequency with which low temperatures occurred. At a mean day-and-night temperature of 21·7°C. [71·06°F.], development lasted 15·7 days, whereas at 22·7°C. [72·86°F.] it lasted 17·4 days, and this retardation was evidently due to minimum temperatures. The emergence of the parasite from the eggs of the host is also affected by the thermal minimum, and can only reach a peak on a day on which the thermal minimum does not drop below the threshold of development. The number of generations of *Trichogramma* in a given locality is, therefore, determined not only by the sum of effective temperatures, but also by the frequency of minimum temperatures.

In the course of investigations by Tyumeneva on the use of parasites of the genus *Trichogramma* against *Cydia pomonella*, L., in the district of Slavyansk (northern Caucasus) it was found that the percentage reductions in infested fruit, as compared with the controls, given by *T. pallida* and the Astrakhan and Azov-Black-Sea races of *T. evanescens* were 42·7, 29·9 and 18·1, respectively, and in work at Sochi by Derevyanikin against *C. funebrana*, Treitschke, on plum, *T. pallida* was again the most effective, but the Azov-Black-Sea race of *T. evanescens* was better than the Astrakhan race. In investigations in the Crimea by Kamenkova, the Romnui race of *T. evanescens* and *T. turkestanica* could not tolerate so wide a range of temperature and relative humidity as the Azerbaijan race, while the Astrakhan race was the most adaptable. Thus, 17 successive generations of the Astrakhan race were bred at the high constant temperature of

32°C. [89·6°F.] and the low relative humidity of 30–35 per cent., with no detrimental effect on fertility or the viability of the progeny. This race is, therefore, recommended for use against *C. pomonella* in the non-irrigated orchards of Central Asia, the Crimea and the steppe zone of Azerbaijan.

Laboratory studies by Alekseev on the mass breeding of *Eurygaster integriceps*, Put., in winter showed that bugs that had been kept for 14 days at a temperature of from −1 to 1°C. [30·2–33·8°F.] and were then transferred to 25–30°C. [77–86°F.] began to oviposit 10 days later, provided that continuous light was maintained Individuals that had been kept for 14 days at −3°C. [26·6°F.] before transfer to the higher temperature oviposited 13 days later, but those kept at −9°C. [15·8°F.] did not oviposit and soon died. Parasites that were observed attacking the eggs of the Pentatomid in the Province of Stalin (southern Ukraine) in the summer of 1939 comprised, in order of decreasing frequency, *Dissolcus rufiventris*, Mayr, *Telenomus* (*Phanurus*) *politus*, Thoms., *Hadronotus pedester*, Kieff., *Telenomus sokolowi*, Mayr, *Microphanurus semistriatus*, Nees, and *M. vassilievi*, Mayr. The life-cycle of *M. semistriatus* was completed in 23 days at a mean temperature of 20·2°C. [68·36°F.] and 69·5 per cent. relative humidity, and in 14 days at 24·9°C. [76·82°F.] and 70·3 per cent. Females constituted 77–84 per cent. of the population, and deposited 89–109 eggs.

Observations by Lapina in the Province of Voronezh showed that the comparative scarcity of *Mayetiola destructor*, Say, in some years is due largely to parasites, of which *Merisus destructor*, Say, and *Pleurotropis metallica*, Nees, were the most important, others including *Eupelmus atropurpureus*, Dalm., *E. microzonus*, Först., *Eupteromalus micropterus*, Lind., *Platygaster* spp. and *Ceraphron* sp. The total percentage parasitism was 67–72 and 82–93 in crops sown in autumn and spring, respectively, and this difference may have been partly due to the fact that different parasites are active at different times of the year.

Work by Livshitz on the Aphids that infest cotton in the district of Anapa on the Black Sea showed that an infestation is not evenly distributed throughout a field. A decrease in the abundance of the Aphids in summer was due not to the dry hot weather, but to the activity of parasites, of which *Aphidius cardui*, Marsh., was the most important, and predacious Coccinellids, of which *Coccinella septempunctata*, L., and *Adonia variegata*, Gze., were the commonest [*cf.* **26** 353]. *Propylaea quatuordecimpunctata*, L., was less frequent.

The results of four years' work by Telenga on the value of releasing *Chilocorus* spp. against *Aspidiotus perniciosus*, Comst., in the Russian Union [*cf.* **27** 303, 316] showed that although liberation in spring reduces the abundance of the overwintered Coccids, mass breeding of the Coccinellids in winter is difficult and both larvae and adults are attacked by parasites.

Pospelov (V. P.). **Results of the Utilisation of fungous, bacterial and Virus Diseases as a Control Measure against agricultural Pests,** pp. 125–129. Experiments with *Cephalosporium lecanii* against the wax scale [*Ceroplastes sinensis*, Del G.] on *Citrus* [*cf.* **27** 308] were continued in the district of Batum in 1939. Spraying infested trees with a suspension of a culture of the fungus (at the rate of 1 oz. in 1 pint water) killed 45 per cent. of the adults and 60 per cent. of

the nymphs in 30 days, as compared with 0·5 per cent. mortality in the control. The weather conditions were mostly favourable for the growth of the fungus, the relative humidity averaging 86 per cent. and the temperature 18°C. [64·4°F.]. At a lower temperature, which dropped to below 15°C. [59°F.] at night, only 35 per cent. of the Coccids were killed.

In laboratory experiments by Evlakhova, Pentatomids [? *Eurygaster integriceps*, Puton] readily sucked a bait made of an aqueous suspension of a culture of the white muscardine fungus [*Beauveria bassiana*], and were subsequently killed by it. Spraying infested wheat with the suspension also killed the bugs. It was shown by Medvedeva that when a culture of the fungus was introduced in autumn into forest litter containing hibernating bugs, the percentage mortalities of the latter in spring were 67–73 ; this percentage was increased to 84 when the litter was infested in spring, but mortality in the controls was 31 per cent. When artificially infested bugs were introduced in autumn into the litter in a young forest, the percentage mortality in the spring was 69–76, as compared with 34 in the control. When pads of cotton wool and muslin and piles of weeds wetted with a suspension of the fungus were placed among rows of wheat and under dense growths of weeds, up to 57·5 per cent. of the bugs were killed in ten days in sample plots, whereas the percentage mortality in control plots was only 6. In investigations by Vaduzhev, adults of *Agrotis segetum*, Schiff., in beet fields were attracted to baits of beer must or diluted molasses infected with *B. bassiana*, and the baits did not decompose for 6–10 days ; 75 per cent. of the moths escaped from the containers and oviposited, but their fertility and the viability of their eggs were considerably reduced.

In experiments by Transhe against *Locusta migratoria*, L., at a temperature of 23–24°C.[72·4–75·2°F.] and 80–85 per cent. humidity, all the hoppers died in 6 days and 70–80 per cent. of the adults in 8–10 days after feeding on sprouting wheat sprayed with a culture of *B. bassiana*. At 40–45 per cent. relative humidity, only 80–90 per cent. of the nymphs and 60–70 of the adults were killed in about 10 days.

In experiments by Zaĭtzeva and Andreeva, Metalnikov's bacilli [*cf.* **27** 307] were successfully cultured on the dead bodies of *Eurygaster* and larvae of *Pieris brassicae*, L., and on a broth of *Eurygaster*. Bacilli cultured on *Eurygaster*, however, gave only 10–45 per cent. mortality of living bugs. Bacilli cultured on a yeast medium killed 67 per cent. of *P. brassicae*. Tripoli earth was found of value in the manufacture of concentrated bacteria preparations ; at a fairly quick rate of filtration, 100 gm. of tripoli earth retained almost all the spores in 5 litres of a liquid culture. A powder of the bacilli that had been kept in the laboratory since 1936 was still virulent in August 1939 and killed 95–100 per cent. of the larvae of *P. brassicae* in 2–3 days, whereas a pure culture that had been constantly resown on nutritive media during 1938 and 1939 killed only 20–26 per cent. in 7–8 days.

Experiments by Shvetzova showed that the virulence of a mixed culture of Metalnikov's bacilli (isolated from *Galleria mellonella*, L.) and *Bacterium prodigiosum* was greater than that of the former alone. A culture recovered from larvae of *P. brassicae* that had been infected with the mixture gave complete mortality of larvae of the same species in four days. The effectiveness of the mixture was confirmed in further tests by Imerlishvili in which larvae of *P. brassicae* were sprayed with it at 20 and 25°C. [68 and 77°F.] ; the percentage mortalities

were 98 in 7 days and 100 in 4 days, respectively. Infecting the larvae with a pure culture of *B. prodigiosum* killed 80 per cent. in 8 days at 25°C. All larvae infected with a culture of Metalnikov's bacilli isolated from individuals that had been killed by the mixture died in 6 days.

In field experiments by B. V. Romanevich in the Province of Kiev, a culture of *B. prodigiosum* on potato, washed off with water and mixed with wheat flour, was added to molasses in the proportion of 2 : 1 and placed in containers in beet plantations; adults of *Agrotis segetum* were attracted to the baits, and all those that were caught were transferred to the laboratory, where they became infected and died in 1–2 days.

Sazonov (P. V.). **The Elaboration of Methods of increasing the Effectiveness of Insecticides,** pp. 130–135. Field experiments by E. N. Kozlova in the northern Ukraine on the control of *Cleonus punctiventris*, Germ., on beet showed that by using a highly concentrated (9 per cent.) solution of barium chloride, the amount of spray and of barium chloride applied per acre could both be reduced. When the insecticide was evenly distributed over the surface of the plants, applications at the rate of 9 lb. barium chloride per acre gave adequate control. Since satisfactory control is given at reduced rates of application only in the case of insecticides (such as barium chloride) that are readily soluble in water, Yu. K. Novodranov and E. K. Smirnova studied the possibility of obtaining similar results with less soluble substances by stabilising suspensions of them. Thus, a considerable increase in the stability, dispersion and toxicity of a 5 per cent. suspension of calcium arsenate was obtained by the addition of ammonium alginate, which reduced the minimum lethal dose of the insecticide for larvae of *Pieris brassicae*, L., and increased the percentage mortality from 50·9 to 69, as compared with 7·5 in the controls. The presence of ammonium alginate in the spray was shown by P. I. Kiyashko to reduce the injury to bean leaves caused by calcium arsenate.

In preliminary investigations by P. V. Sazonov on the use against the red spider [*Tetranychus*] on cotton of concentrated suspensions of preparations containing sulphur, very promising results were given by applying suspensions of sulphur pastes of Russian manufacture that were stabilised by the addition of sulphite-cellulose alkali. These suspensions gave 75·7–90 per cent. mortality of the mites, as compared with 64·3 per cent. in the case of a standard sulphur dust. In laboratory and field tests, the effectiveness of a dust of sodium fluosilicate against *Cleonus punctiventris* was considerably increased by the addition of 1 per cent. spindle oil [*cf.* **25** 157].

Kraĭter (A. D.). **The Elaboration of a Standard of the Summer Mineral Oil for the Control of Pests on Fruit Cultures and the Results of Applying Preparations of Winter Oils,** pp. 136–140. To determine the type of petroleum oil that would be most toxic to insect pests and at the same time harmless to plants in summer sprays, laboratory and field tests were carried out by various workers with several fractions of petroleum oils obtained from three different sources in the Russian Union and refined by treatment with 98 per cent. sulphuric acid at concentrations of 5, 10, 50 or 200 per cent. The origin of the oil did not appreciably affect its toxicity to insects or the degree of scorching on the plants, but it did affect the degree of oxidation of the oil

(formation of naphthene acids), which depended on the content of aromatic hydrocarbons and their structure, and was reduced by higher refinement.

Experiments by N. A. Ivanova showed that the degree of refinement of the oils had little effect on their toxicity to eggs of *Sitotroga cerealella*, Ol., only those treated with 200 per cent. sulphuric acid showing increased toxicity. Oils boiling at 300–400°C. were the most effective.

In field tests by A. A. Bogdarina in the district of Slavyansk of the effect on apple twigs of oils emulsified with soap, the least injurious were those refined with 5 per cent. sulphuric acid and boiling at 300–350°C. or 400–450°C. The degree of injury caused depended mostly on the emulsifier used ; soaps increased it, whereas mineral emulsifiers, such as basic ferrous sulphate, basic copper sulphate or fuller's earth decreased it.

On the basis of this research, it is concluded that the petroleum oil for summer spraying should boil at 300–400°C., should be refined with a 5 per cent. concentration of sulphuric acid, irrespective of the initial content of aromatics, and should be emulsified with a mineral emulsifier.

Field tests of coal-tar distillates against the apple Psyllid [*Psylla mali*, Schm.] and the apple Aphid [*Aphis pomi*, DeG.], carried out before the bursting of the buds in five different localities in the Russian Union, showed that an emulsion containing 2 per cent. heavy green oil killed 96–98 and 93–96 per cent. of the eggs, respectively. In tests by F. I. Chernova in an orchard in the Province of Krasnodar, the application during the winter (January or February) of a 2 per cent. emulsion of anthracene oil, or heavy green oil, or of a mixture of anthracene and petroleum oil, gave only 55–86 per cent. mortality of *Aspidiotus pernicious*, Comst., whereas 4 per cent. emulsions killed 76–100 per cent., but caused some scorching. When applied in early spring before the swelling of the buds, 2 and 4 per cent. emulsions of the heavy green oil, anthracene oil, or a mixture of the latter with petroleum oil did not injure the plants and killed 93–100 per cent. of the Coccids. Very good control of the Coccid (95·4–98·4 per cent. uninfested fruits) was obtained in an infested apple orchard 25 years old, in which the usual cultural measures were followed by a thorough application during the dormant period of a 4 per cent. emulsion of petroleum oil.

In tests by A. Ya. Lesnikovskaya on apple in the same Province the application of four cover sprays of a 1 per cent. petroleum oil emulsion, two cover sprays of a stomach insecticide followed by two of a 1 per cent. oil emulsion in the second half of the summer, and four cover sprays of a combination of calcium arsenate and oil gave 73–83, 71–81 and 66 per cent. fruit free from *A. perniciosus*, and 74–85, 79–90 and 94 per cent. free from *Cydia pomonella*, L., respectively.

Nikitin (I. V.). **The Results of Field Tests of Pyrethrum as a Control Measure against Pests,** pp. 140-143. The results of field and laboratory tests with sprays of pyrethrum extracts against numerous pests in different parts of the Russian Union are shown in tables. It is concluded from this and previous work that such sprays are suitable for application against larvae of *Pieris* and *Plutella maculipennis*, Curt., on cabbage, Aphids and flea-beetles on various crops, the gooseberry sawfly [*Nematus ribesii*, Scop.], and the rape blossom weevil [*Meligethes aeneus*, F.].

Blyumberg (G. V.). **The Investigation of Pyrethrum Extracts and new vegetative Poisons,** pp. 143–145. An account is given of work on the extraction of pyrethrins from the green parts of the pyrethrum plant. The flowers and green parts constituted 26 and 74 per cent. by weight, respectively, of plants received from the southern Crimea, and the pyrethrin contents were 0·32 and 0·07–0·08 per cent. Extraction for 5 hours with ethylene dichloride (dichlorethane) at 65–90°C. [149–194°F.] was equally effective when applied to the flowers, the green parts and the seed residue, alone or together, and extracts from the green parts were as toxic as those from the flowers. Laboratory investigations showed that mineral oils with a viscosity not exceeding 1–2° Engler at 50°C. [122°F.] were the best carriers for pyrethrum extracts. To transfer the pyrethrins into the mineral oil, the oleoresin obtained after the vacuum distillation of the solvent was heated for two hours in a water bath with the oil in the ratio of 1 : 1, 1 : 1·5 or 1 : 2. These methods of hot extraction and of obtaining the dispersion of the pyrethrins in mineral oils were used in commercial production, and tests showed that the extracts obtained were as toxic to *Brevicoryne brassicae*, L., as those prepared in the laboratory.

In investigations by M. G. Timoshenko on solvents for extracting the active principles from introduced species of *Tephrosia*, the best results were obtained with chlororganic compounds, such as chloroform, carbon tetrachloride, trichlorethylene, or ethylene dichloride, while benzene was the best of the aromatic series. The toxicity of the extracts was greater when they were dispersed in mineral oils. Extracts obtained by the hot method were more effective than those from cold extraction.

[Maksimovich (A. E.) & Mikul'skiĭ (A. A.).] **Максимович (A. E.) і Мікульский (A. A.). Concentrated Water-soluble Bait Preparations for the Beet Weevil made of Vegetable raw Material.** [*In Ukrainian and German.*]—*Rep. Acad. Sci. ukr. SSR* no. 12 pp. 41–46. Kiev, 1940. (With a Summary in Russian.)

Experiments in the Ukraine have shown that water in which beet-seed residue has been steeped for many hours is an effective bait-spray when used with an insecticide for the control of the beet-weevil [*Cleonus punctiventris*, Germ.]. It would be necessary, however, to prepare a concentrated extract on a factory scale if the spray were to be used for the treatment of the extensive areas in which beet has been grown in the previous year and in which the overwintered weevils emerge. A series of experiments in 1940 showed that concentrated water-soluble baits, from which sprays more effective than the original one were prepared, could be obtained by extracting beet-seed residue or the stems of seed-beet with hot water and then evaporating the extract till it was almost dry. The stems of seed-beet are available in large quantities and yield about 7 per cent. of their weight of concentrated extract. This is used at a concentration of 1 per cent. for a spray applied at the rate of about 40 gals. per acre.

[Maksimovich (A. E.) & Mikul'skiĭ (A. A.).] **Максимович (A. E.) і Мікульский (A. A.). Dust Bait Preparations for the Beet Weevil.** [*In Ukrainian and German.*]—*Rep. Acad. Sci. ukr. SSR* no. 12 pp. 47–52. Kiev, 1940. (With a Summary in Russian.)

As extracts attractive to the beet weevil [*Cleonus punctiventris*, Germ.] can be obtained from dry plant material [*cf.* preceding abstract],

it was thought that such material might also be attractive in the form of a dust. Experiments were therefore carried out with various preparations, including dusts made of dried beet leaves or seed-beet stems and one, called vegetable dust, obtained as a by-product from a beet-seed factory. Each of these dusts was more attractive to the weevil than a freshly prepared water extract of beet-seed residue, but, when applied to young oats, the dust of seed-beet stems was less attractive than the other two. Mixed with sodium fluosilicate and applied to sprouting oats, vegetable dust gave a much higher percentage mortality of the weevils than did a spray containing the seed-residue extract. The main source of dust for use on a large scale would be beet leaves and stems of seed-beet. The dry leaves are easily pulverised, but special mills would be needed to grind the tough beet stems. The amount of dust required per acre was not ascertained, but would probably be 14–15 lb. for each application.

Dodd (A. P.). **The Biological Campaign against Prickly-pear.**—Med. 8vo, ii+177 pp., col. frontis., 36 pls., 6 graphs, 1 fldg. map, 34 refs. Brisbane, Qd., Commonw. Prickly-Pear Bd., 1940.

This important publication, which should be consulted in the original for details, comprises a full account of the highly successful attempt to control and eradicate prickly-pear (*Opuntia*) in Queensland and New South Wales by means of insect enemies introduced from America by the Commonwealth Prickly-Pear Board, which was set up in 1920 [*R.A.E.*, A **9** 565]. Much of the information has already been noticed from shorter reports [**17** 105; **18** 287; **25** 78; **28** 316, etc.].

Following a general discussion and summary of the problem, successive sections deal with species of prickly-pear and other cacti, their introduction into Australia and the problem of their control; the Board and its policy; insects and a mite (*Tetranychus opuntiae*, Banks) that attack prickly-pear in North, Central or South America; fungous and bacterial diseases of prickly-pear and other cacti; the precautions taken to ensure that none of the insects selected for liberation would attack plants of economic value; the introduction and establishment of *T. opuntiae* and insects other than *Cactoblastis cactorum*, Berg, with notes on the bionomics of some of them; the introduction, establishment, life-history and outstanding progress of *C. cactorum*; and the factors, including temperature, disease and natural enemies that may tend to reduce it. Of the parasites, only two, *Antrocephalus* (*Stomatoceras*) *melitarae*, Gir., and *A.* (*S.*) *stokesi*, Crwf., both of which attack the pupae, are of any importance, and it is thought that an equilibrium between parasites and host has been reached and that the continued efficiency of *Cactoblastis* is unlikely to be impaired by their presence.

Petch (T.). **An *Empusa* on a Mite.**—*Proc. Linn. Soc. N.S.W.* **65** pt. 3–4 pp. 259–260. Sydney, 1940.

In the course of a population study of *Halotydeus destructor*, Tucker, in a clover pasture in Western Australia [*R.A.E.*, A **27** 131], K. R. Norris observed that the mite was attacked by a fungus that is here described as *Empusa acaricida*, sp. n. Infested mites had the whole of the dorsal surface and the sides of the body coloured yellowish-brown instead of black, this area being sharply demarcated from the

black ventral surface. The change of colour is due to the presence immediately below the cuticle of a mass of hyphal bodies. Mites killed by this fungus are attached to the food-plant by their mouth parts, or are entangled in the tomentum of the leaf. Those attacked by it can be recognised by the change in colour at least 19 days before they die. Reference is made to instances of a change in the coloration of insects due to infestation by fungi.

SMEE (C.). **Report of the Entomologist, 1940.**—7 pp. typescript. [Zomba]. Dep. Agric. Nyasaland [1941].

In 1940, small numbers of *Platyedra gossypiella*, Saund., were found on cotton throughout the Shire River valley in the Nyasaland Protectorate [*cf. R.A.E.*, A **29** 153], and attention is again drawn to the necessity for a dead season between crops to control this pest. No diapausing larvae have been found between double seeds, but a few were observed to diapause for 3–4 months in sealed cocoons formed in the lint among seed cotton. The Braconid parasite, *Microbracon kirkpatricki*, Wlkn., appears to be fairly well established in the Lower Shire district. *Apanteles diparopsidis*, Lyle, was observed parasitising small larvae of *Diparopsis castanea*, Hmps., on late bolls towards the middle and end of the season, but gave insignificant control. *Mesochorus ornatus*, Wlkn., was reared from a species of *Rhogas* parasitising larvae of *Earias* on cotton.

Pheidole megacephala, F., can be controlled in tobacco seed-beds by the application of pyrethrum powder, which is also effective against small leaf-eating larvae, and does not injure the germinating seed or the very young plants. Against the ants, the soil should be raked lightly immediately after sowing and the pyrethrum applied first at the edges of the beds. If necessary, frequent applications should be made until the seeds germinate.

The initial infestations of tea by *Niphadolepis alianta*, Karsch [**28** 306] were considerably reduced in 1940, but outbreaks occurred on other estates in Cholo and on one in Mlanje [**29** 61]. In Cholo, the total percentage mortality of the larvae increased to 69, of which 89 per cent. was due to the "wilt" disease and the remainder to parasitism by a species of *Chrysis* [*cf.* **29** 61, 154]. The larvae that spun cocoons in April and May entered diapause, but many of them were already diseased, and the numbers of adults emerging at the end of the year were consequently much reduced; at the end of December, 70 per cent. of the cocoons contained dead larvae and pupae. Adults emerged from 11 of the cocoons collected in June 1939 [*cf.* **29** 61] after periods of 450–549 days. Other pests of tea included a Psychid of the genus *Acanthopsyche*; an Agromyzid leaf-miner, which was heavily parasitised by *Opius* sp. and *Teleopterus violaceus*, Ferrière; and *Pseudococcus perniciosus*, Newst. & Willc., which appears to be increasing in the Cholo district, but is attacked by the predacious larvae of *Eublemma costimacula*, Saalm. It has been found that the flea-beetle that attacked tea in 1931 and was then recorded as *Podagrica* (*Nisotra*) *suahelorum*, Weise [**20** 668] is another species, probably of the same genus, the larvae of which mine the leaves of the weed, *Bidens pilosa*, and pupate in the ground.

Termites attacking tung [*Aleurites*] at Zomba were identified as *Termes vulgaris*, Hav., *Allodontermes morogorensis*, Harris, *Acanthotermes* sp. and *Microtermes* sp. They all construct runways from the

soil level up the main trunk, penetrate the wood where possible and, unless prevented by the resultant exudation of gum, may damage large areas of the trunk, sometimes killing the tree. Sprinkling a complete circle of dry Paris green over the base of the tree and the soil touching it gave considerable protection against attack, and this treatment is recommended for plantations in which termite activity is prevalent during the dry season or during dry weather in the rainy season. Second-generation larvae of *Laphygma exempta*, Wlk., occurred on maize in April and May at Zomba, the adults emerging in June; some of the larvae were parasitised by a Tachinid and a species of *Apanteles*. Other pests that caused local damage during the year comprised *Helopeltis bergrothi*, Reut., on pigeon pea [*Cajanus cajan*], *Teleonemia australis*, Dist., on the foliage of olive, the Cassidid, *Conchyloctenia parummaculata*, Boh., which was parasitised by a Tachinid, on that of sweet potato, and *Pseudococcus brevipes*, Ckll. (*bromeliae*, auct.), on pineapple. It was thought possible that a discolouring blemish of *Citrus* fruits was caused by the mite, *Phyllocoptruta* (*Phyllocoptes*) *oleivorus*, Ashm.

Hoppers of *Nomadacris septemfasciata*, Serv., which, with the possible exception of a swarm that may have included examples of *Locusta* [*migratoria migratorioides*, R. & F.] as well, was the only locust in the Protectorate, were less numerous than had been anticipated [*cf.* **29** 154] and were largely controlled by spraying and beating and by the fungus, *Empusa grylli*. Damage to crops was small, partly owing to their advanced growth at the time they were attacked. There were relatively few flying swarms; the first developed at the end of February, and others appeared during March. Active flying swarms entered most of the southern districts by the end of October, mainly in a westerly or north-westerly direction, but movement was sporadic in November owing to heavy local rains interspersed with hot, dry periods. Oviposition began about 20th November and continued in December. Small bands of hoppers appeared about 10th December in Lower Shire and spraying and beating were begun immediately; more extensive hatching occurred later, but the situation did not appear to be serious at the end of the year.

NOTLEY (F. B.). *Antestia* **in the Northern Province of Tanganyika.**—*E. Afr. agric. J.* **6** no. 4 pp. 194–198, 2 figs., 4 refs. Nairobi, 1941.

Studies on the incidence of *Antestia* on coffee, carried out in three districts in the Northern Province of Tanganyika by means of monthly test spraying [*cf. R.A.E.*, A **23** 144], showed that populations tend to increase during the hot season (October–March) and to remain stationary or to decrease during the remainder of the year. Correlation of population figures and damage to the coffee berries [*cf.* **26** 178] indicates that loss due to small populations is more serious than has been realised, the average loss in all the samples examined being 14·9 per cent. An average of only one *Antestia* per tree throughout the year appears to cause a total damage of about 16 per cent. [*cf.* **29** 177], and it is suggested that control measures should begin in October, and that from October to the end of March the population should not be allowed to increase above an average of one per tree in any part of the population. Bait sprays of [sodium] arsenite [*cf.* **23** 70; **24** 649 etc.] appear to be very effective during the hot dry weather only, and

pyrethrum dusts [*cf.* **24** 240; **25** 219] should be used at all other times. It is, therefore, recommended that after the crop is harvested in August–November, arsenite bait sprays should be used until the beginning of the rains, and if this treatment is unsuccessful, or if the population is still dangerously high at the end of March, pyrethrum dusts should be applied where necessary.

Parasitism of *Antestia* by the Stylopid, *Corioxenos antestiae*, Blair [*cf.* **26** 179], was of considerable importance in two districts where the coffee is heavily shaded, but not in the third, where it is almost entirely unshaded. It seems that the parasite requires a rather high host population if it is to become numerous, but remains common even in low densities of host population during the cold weather. There is no indication that either pyrethrum dusting or the bait-spray adversely affects the percentage parasitism by *C. antestiae*, except by reducing the density of the host population.

HARRIS (W. V.). **Termites in East Africa III—Field Key and Distribution (by Territories).**—*E. Afr. agric. J.* **6** no. 4 pp. 201–205, 12 figs. Nairobi, 1941.

This third paper of a series [*cf. R.A.E.*, A **29** 338] includes a key to the soldier castes of the genera of termites that are known to occur in East Africa, a list of the species recorded from Tanganyika, Kenya, Uganda and Zanzibar, showing which occur in each country, and brief notes on the habits of the four Ethiopian families, each of which is represented in East Africa.

JACOB (F. H.). **The Over-wintering of *Myzus persicae* Sulz. on Brassicae in North Wales.**—*Ann. appl. Biol.* **28** no. 2 pp. 119–124, 3 refs. London, 1941.

The following is substantially the author's summary of observations on the overwintering of *Myzus persicae*, Sulz., made in North Wales between 1937 and 1940. No evidence was obtained to support a statement by F. V. Theobald that *M. persicae* oviposits on winter cruciferous crops, but the importance of these crops, particularly savoy cabbage, in providing shelter for overwintering viviparae [**22** 386] was confirmed. The most favourable plants are those of low growth and with crinkly or curly leaves; the Aphids concentrate chiefly on the lower leaves both of the winter food-plant and of potato, unlike *Brevicoryne brassicae*, L., which occurs as near the heart of the plants as possible. Observations during the winter of 1937–38 indicated that *M. persicae* did not overwinter on cruciferous crops in fields, but no particular attention was paid to gardens, and it is possible that a few Aphids overwintered on savoys in sheltered places. In 1938–39, considerable numbers overwintered under both garden and field conditions, savoys being the preferred food-plant; savoys in the garden under observation were left in the ground considerably longer than they would normally have been. Weather conditions were very different during the winter of 1939–40, and after the hard frost in January, Aphids could not be found out of doors in any situation. These results suggest, therefore, that the apterous forms overwinter readily on cruciferous crops in North Wales under favourable weather conditions, but that in some seasons none survives out of doors. Peach

trees are probably of minor importance as winter food-plants in North Wales, but glass houses form a reservoir from which large numbers of Aphids may migrate in spring and early summer.

From detailed studies of populations of *M. persicae* on potato crops in North Wales, it appears probable that years of high infestations on potato follow winters when widespread hibernation on crucifers has occurred, and years of low infestation follow winters when few or no Aphids overwinter on them.

POTTER (C.). **A Laboratory Spraying Apparatus and Technique for investigating the Action of Contact Insecticides. With some Notes on suitable Test Insects.**—*Ann. appl. Biol.* **28** no. 2 pp. 142–169, 1 pl., 5 figs., 16 refs. London, 1941.

Studies were carried out to determine a laboratory method of applying sprays containing contact insecticides in equal doses to large numbers of insects belonging to a wide variety of species. Methods described by other workers are discussed [*R.A.E.*, A **19** 121; **20** 323; **23** 81; **24** 214; B **26** 246], and an account is given of the investigations leading to the development of the apparatus finally adopted, which is described. It has a reservoir and a specially-designed atomising nozzle mounted on a small circular plate carried on three bars each at an angle of 120° with the others. The end of each bar rests on the top of a metal tower* through which the spray is directed on to a spray plate or dish. This plate is carried on another, which is fitted with a universal adjustment. The whole apparatus is mounted on a wooden stand. Tests performed to determine its physical performance are described.

Notes are also given on the selection and rearing of test insects. Aphids appear to be generally susceptible and are therefore considered to be the most suitable for the preliminary study of an insecticide, and pests of stored grain are recommended where more resistant species are required. *Macrosiphum* (*Macrosiphoniella*) *sanborni*, Gill., was reared throughout the year on chrysanthemum plants, varieties with sappy growth being the most satisfactory; when large numbers of undersized Aphids appear among the stock, a fresh one should be raised from selected healthy individuals. *Aphis rumicis*, L., reared on beans can be used for a short period in the summer; its resistance appears to be higher than that of *M. sanborni*. *Oryzaephilus surinamensis*, L., was reared in glass jars 8 ins. high and 4 ins. in diameter, each containing food (rolled oats and sultanas previously fumigated with carbon bisulphide and aired for at least 24 hours) to a depth of 4 ins. and 100 adults, and covered with muslin and kept at a temperature of 27°C. [80·6°F.] and a relative humidity of 70 per cent. Under these conditions, the life-cycle occupied about a month, and the adults lived at least six months. Investigations on the causes of variations in the mortality obtained in a given species from applications of a given insecticide at a given dosage are described, and the spraying techniques adopted as a result for Aphids and for pests of stored products are summarised.

* [We are asked by the author to point out three errors in the measurements of the spray tower given on page 147 of the paper. As corrected, the sentences in question read as follows:—"The tube is 27 in. long, both the top and the bottom having a 1 in. flange. The internal diameter of the top is 6¼ in. tapering to 4¾ in. in 12 in., the rest of the tower being of uniform 4¾ in. bore."—*Ed.*]

Papers Noticed by Title only.

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Park (T.). **Studies in Population Physiology. VIII. The Effect of Larval Population Density on the postembryonic Development of the Flour Beetle,** *Tribolium confusum*.—*J. exp. Zool.* **79** no. 1 pp. 51–70, 3 figs., 13 refs. Philadelphia, Pa., 1938. [Recd. 1941.] [*Cf. R.A.E.*, A **25** 528, etc.]

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